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MECHANICAL  
EQUIPMENT

THE AMERICAN SOCIETY *of*  
MECHANICAL ENGINEERS  
1912

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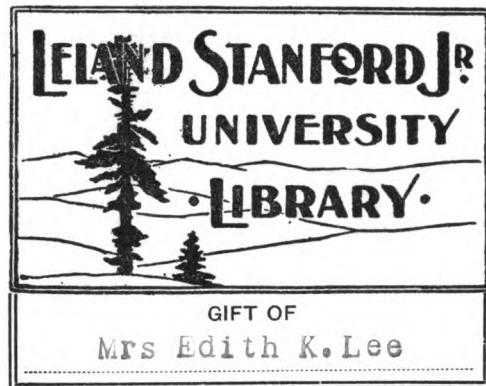
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# **CONDENSED CATALOGUES *of* MECHANICAL EQUIPMENT**

**A collection of Catalogue Data concerning the products  
of two hundred and eighty-five manufacturers  
of Mechanical Equipment**

**SECOND ANNUAL VOLUME  
DECEMBER 1912**

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**THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS  
29 WEST 39TH STREET  
NEW YORK**

**T**HE purpose of the Condensed Catalogues is to present in the most concise form possible such facts as are likely to be required for purposes of preliminary reference by engineers, superintendents, managers and other mechanical and executive heads of industrial plants.

The first annual volume of Condensed Catalogues demonstrated the great practical usefulness of this coöperative catalogue of mechanical equipment.

Issued primarily in the interest of the engineering profession, it has attracted the attention of others identified with the maintenance and purchase of mechanical equipment to such a degree as to render necessary a much wider distribution of subsequent issues than was originally contemplated.

The second annual volume contains a great deal of new matter and is much more comprehensive than the first volume. The initial stage successfully passed, each succeeding volume can be counted upon to become more completely representative of the principal manufacturers in every department of mechanical equipment.

**207421**

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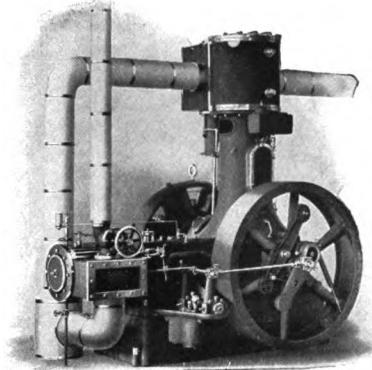


## AMERICAN ENGINE COMPANY

42 RARITAN AVENUE  
BOUND BROOK, N. J.

ALL KINDS OF HIGH GRADE SIMPLE AND COMPOUND STEAM ENGINES, DIRECT-CONNECTED UNITS, MOTORS AND GENERATORS.

## THE AMERICAN-BALL ANGLE COMPOUND ENGINE



The American-Ball Angle Compound Engine has all of the advantages possessed by every American engine, an automatic system of lubrication, sensitive balanced automatic governor, adjustable cross head guides, attached indicator reducing motion, high-class workmanship, etc. Besides these, some of the special advantages inherent to the angle construction are as follows:

(1) With the cylinders at right angles, practically perfect balancing is secured.

(2) The angle construction, with its four impulses per revolution, gives a practically uniform torque, making this engine especially adaptable for driving alternators which are to be run in parallel.

(3) With no dead centers, the engine can be started from any position.

(4) Small floor space. The Angle Compound Engine gets twice as much power on the same amount of floor space as does a simple engine.

These matters are fully discussed, with appropriate diagrams, in our pamphlet on "The Modern High-Speed Automatic Engine."

The American-Ball Angle Compound Engine has been widely adopted for generating power in isolated plants.

We have prepared a special report on the cost of isolated plant power, which we will be pleased to send to engineers interested in this branch of engineering.

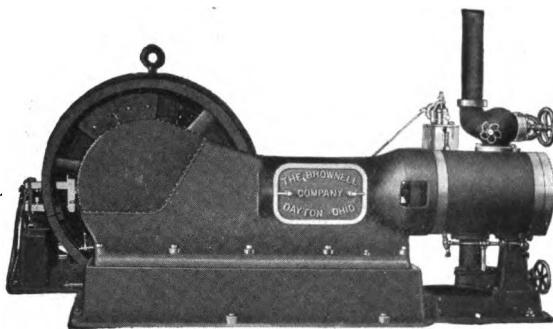
## DIMENSIONS OF AMERICAN-BALL ANGLE COMPOUND ENGINES

Horsepower	FOR BELTED SERVICE							FOR DIRECT-CONNECTED SERVICE								
	Cylinder Diameters and Stroke	Revolutions per Minute	Length	Floor Space	Width	Steam and Exhaust Pipes	Shipping Weight Pound	K. W.	Cylinder Diameters and Stroke	Revolutions per Minute	Length	Floor Space	Width	Steam and Exhaust Pipes	Direct Connected Engine	Shipping Weight in Pounds
120	12 & 19 x 10	325	103	85	4	6	12,000	75	12 & 19 x 10	325	103	107 $\frac{1}{2}$	4	6	12,200	17,000
160	13 & 20 x 11	300	111	93 $\frac{1}{2}$	4	7	14,900	100	13 & 20 x 11	300	111	112	4	7	15,200	21,100
250	16 & 25 x 12	285	125	110	6	9	23,000	150	16 & 25 x 12	285	125	120 $\frac{1}{2}$	6	9	21,400	32,200
325	18 & 28 x 14	260	138	126	6	10	30,000	200	18 & 28 x 14	260	138	132 $\frac{1}{2}$	6	10	27,900	40,000
400	20 & 32 x 15	250	145	141	7	12	37,600	250	20 & 32 x 15	250	145	156 $\frac{1}{2}$	7	12	31,700	45,000
500	22 & 34 x 16	240	154	158	8	12	45,000	300	22 & 34 x 16	240	154	165	8	12	39,200	
650	25 & 38 x 18	225	164	182	9	14	59,000	400	25 & 38 x 18	225	164	174	9	14	51,000	

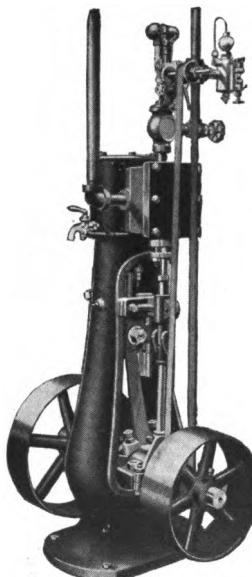
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**"DAYTON" VERTICAL STEAM ENGINES**  
for Simplicity and Small Floor Space.

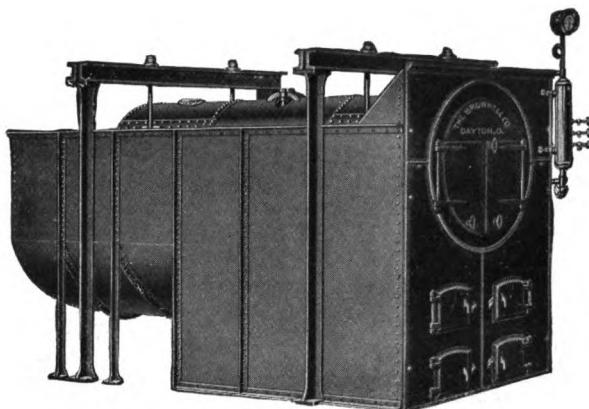
**Carried in Stock:**

From $3\frac{1}{2} \times 4$	2 H.P.
To $7\frac{1}{2} \times 8$	16 H.P.

This engine is furnished separately or combined with our Vertical boiler on one solid base. The combined outfit makes an ideal self-contained power plant and cannot be equalled for compactness, simplicity and ease of operation.

Our Data Bulletin No. D-112 will be useful to you, and will be mailed upon request to Managers, Superintendents and Engineers.

**THE BROWNELL CO.**  
DAYTON, OHIO

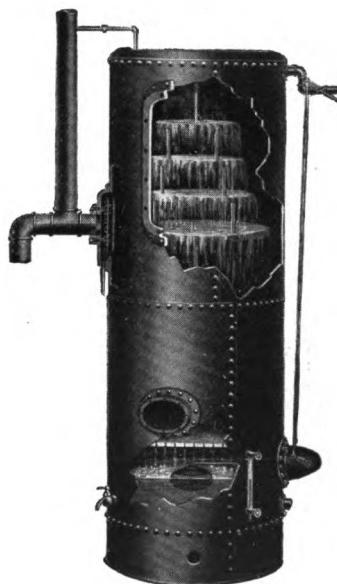


**BOILERS OF EVERY CLASS AND SIZE  
FOR ANY CONDITION OF SERVICE**

All of our Boilers are built under the direct inspection of, and tested by, a special licensed boiler inspector of the Hartford Steam Boiler Inspection and Insurance Company, and will be insured for one year *free of charge*, if desired.

**FEED WATER HEATERS AND LIME  
EXTRACTORS, OPEN AND  
CLOSED TYPES**

Percents you save in fuel consumption by  
heating feed water:



Final Tempera- ture	INITIAL TEMPERATURE OF WATER				
	32°	40°	50°	60°	70°
60°	2.39	1.71	0.86		
80	4.09	3.43	2.59	1.74	0.88
100	5.79	5.14	4.32	3.49	2.64
120	7.50	6.85	6.05	5.23	4.40
140	9.20	8.57	7.77	6.97	6.15
160	10.90	10.28	9.50	8.72	7.91
180	12.60	12.00	11.23	10.46	9.68
200	14.30	13.71	13.00	12.20	11.43

Our Data Bulletin No. D-112 will be useful to you, and will be mailed upon request to Managers, Superintendents and Engineers.

**BALL ENGINE CO.**  
**ERIE, PENNSYLVANIA**

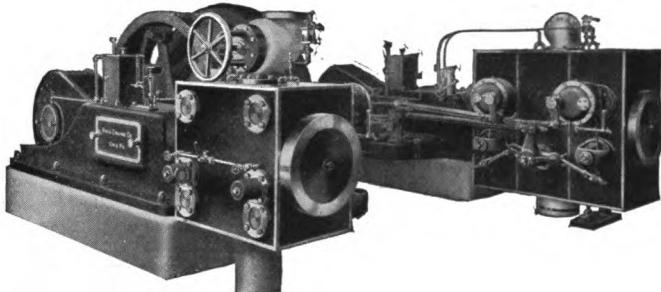
**CORLISS-VALVE AND SINGLE-VALVE ENGINES; HORIZONTAL AND VERTICAL SIDE-CRANK ENGINES; TANDEM AND CROSS-COMPound SINGLE-VALVE ENGINES, CORLISS-VALVE COMPOUND AND SINGLE-CYLINDER ENGINES.**

**HIGH-SPEED CORLISS ENGINES**

The feature which distinguishes this engine from other four-valve shaft governed engines is the patented non-detaching valve gear, which imparts the same movement to the valves that the drop cut-off of the slow-speed Corliss produces by picking up and dropping them. This permits the use of the best form of valve, and the valves are given the movement necessary for the greatest durability and tightness.

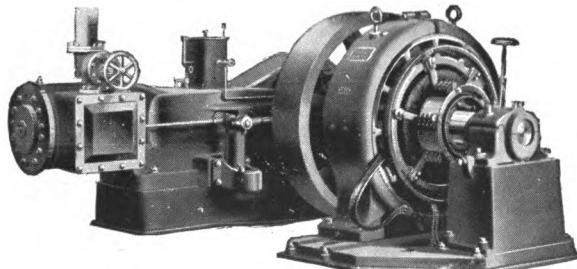
Built in sizes from 100 h.p. to 1200 h.p. in the single-cylinder and cross-compound types.

These engines excel in economy and regulation and are especially adapted for electric service.



**SINGLE-VALVE AUTOMATIC ENGINES**

These engines are the result of a long experience in building engines for electric service. They are superior in design and construction. The regulation and economy are the best of their type.

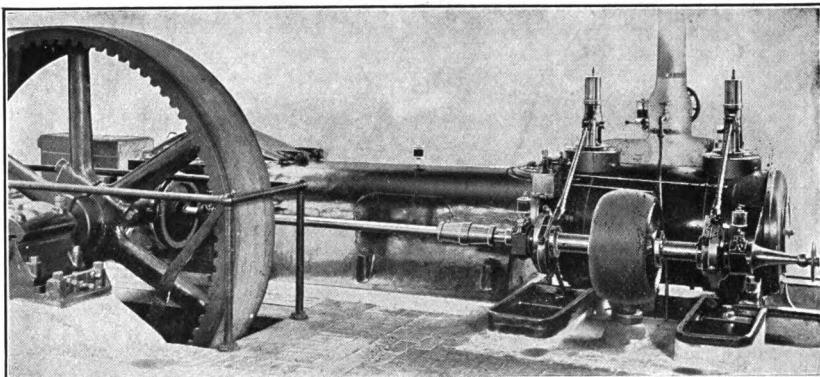


Built in sizes from 25 h.p. to 800 h.p. in the single-cylinder, tandem-compound and cross-compound types.

## ERIE CITY IRON WORKS

ERIE, PENNA.

STEAM ENGINES AND BOILERS. FEED WATER HEATERS. HORIZONTAL AND VERTICAL WATER TUBE BOILERS. LENTZ ENGINES.



The Lentz Engine

### A PROVISION FOR THE NECESSITY CONFRONTING AMERICAN MANUFACTURERS FOR ECONOMY IN THE USE OF FUEL

We are approaching a condition in this country that exists in other countries, that is: *extreme economy must be practised in every department of every business to make a fair showing*, and this applies with especial force to the coal pile.

After an extended investigation we have become convinced that the Lentz engine, using superheated steam is the most economical of all prime movers, and have secured the American rights for manufacturing it under the patents of Hugo Lentz, of Germany.

#### CONSTRUCTIONAL FEATURES

Throughout the engine there is no elastic packing used. The valves are of the double-seated poppet type, and the valve spindles are ground to fit in long bushings with water grooves, and no packing is used in this construction. The valve is so designed that it can stand high temperature or changes of temperature without affecting its tightness, and as there is no rubbing surface it stands equally well under a high degree of superheat or saturated steam. The valves are actuated by a cam working on a roller, these parts being all case hardened. When the valve comes to a seat the cam is disengaged, but the roller and cam are always in contact until the valve has been seated, consequently, there is no noise, nor is there any limit to the revolutions at which the valve gear may be run.

The governor is extremely simple in its construction; consisting of an inertia weight, two pendulae and one small flat spring. It utilizes its inertia in a very novel and unique manner. The outer ring, running loose on the lay shaft instead of being rigidly connected to it, as is the case in most other governors, influences directly the governor spring and the pendulae. With the slightest change of load and consequently of speed, this inertia force acts before the centrifugal forces which have to first overcome the friction existing before they can possibly become operative. The consequence of this novel combination of inertia and centrifugal action is a greatly increased sensitiveness and quickness in action.

When required, the engine is provided with a hand-speed adjustment, and the speed of the engine can be varied while in operation. As noted in the illustration herewith, the engine is extremely simple and very accessible. All details have been fully patented by Mr. Hugo Lentz of Germany, and we have the exclusive rights under these patents in the United States.

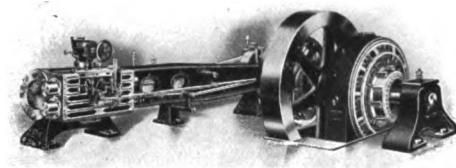
We are prepared to demonstrate that this is the most economical steam engine that has ever been made. We have offices in all the important centers, and it would be a pleasure for us to have a representative call and go into the details of this engine. This engine is built single cylinder, tandem and cross-compound.

## THE FITCHBURG STEAM ENGINE CO.

FITCHBURG, MASS.

SINCE 1870 MANUFACTURERS OF STEAM ENGINES  
FOR USE UNDER EVERY SORT OF CONDITION

"THE FITCHBURG"—DIRECT-CONNECTED—GIRDER BED



Sizes 7" by 18" to 22" by 42". Revolutions 80 to 250.

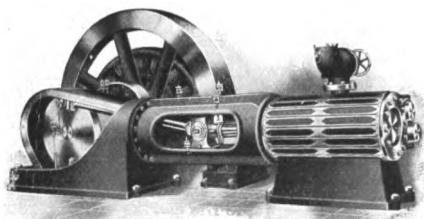
Detailed description of "THE FITCHBURG" on application.

D. Con. or Belted	Girder Bed as above	To	300 H.P.
" "	Tangye Bed as below	"	800 "
" "	Tandem Girder	"	300 "
" "	Tandem Tangye	"	800 "
" "	Cross Girder	"	750 "
" "	Cross Tangye	"	1500 "
" "	High-Speed Horizontals	"	250 "
" "	Single Cylinder Vertical	"	400 "
" "	Steeple Comp'd Vertical	"	400 "

Details for any size given on application.

Detailed description of "THE FITCHBURG" on application.

"THE FITCHBURG"—DIRECT-CONNECTED—TANGYE BED



Sizes 12" by 18" to 30" by 48". Revolutions 80 to 250.

# HEWES & PHILLIPS IRON WORKS

Established 1845

NEWARK, N. J.

CONTRACTING ENGINEERS AND MANUFACTURERS OF PATENT DOUBLE-PORTED CORLISS ENGINES, SIMPLE OR COMPOUND, CONDENSING AND NON-CONDENSING FOR EITHER BELTED OR DIRECT-CONNECTED ELECTRICAL DRIVES. EQUIPPED WITH FRANKLIN PATENT HORIZONTAL GRAVITY-LATCH RELEASING VALVE GEAR

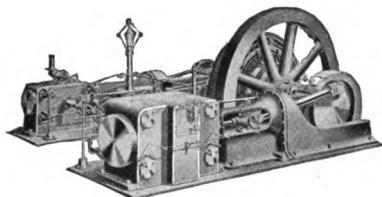
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Also CORLISS FOUR-VALVE ENGINES, NON-RELEASING TYPE. Equipped with Robb-Armstrong-Sweet Inertia Shaft Governor, Automatic Unit-Tank Oiling and Filtering System. SPECIALLY DESIGNED AND CONSTRUCTED FOR DIRECT-CONNECTED ELECTRICAL INSTALLATIONS IN COMMERCIAL BUILDINGS

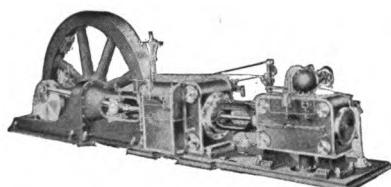
NAYLOR VORTEX STEAM SEPARATORS  
INDEPENDENT STEAM-DRIVEN VENTURI AIR PUMPS AND CONDENSERS

BAROMETRIC CONDENSERS  
HEAVY IRON AND BRASS CASTINGS  
COMPLETE STEAM POWER PLANTS A SPECIALTY

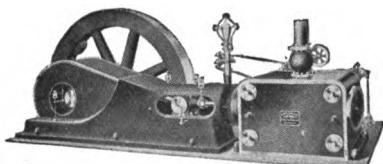
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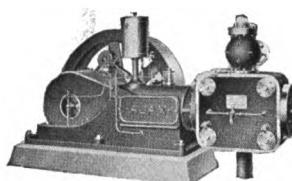
Cross Compound Heavy-Duty Engine  
Rotative Speed 100 to 150 Rev. Per Min.



Tandem Compound Heavy-Duty Engine  
Rotative Speed 100 to 150 Rev. Per Min.



FRANKLIN  
Corliss Heavy-Duty Engine, Releasing  
Valve Gear. Rotative Speed  
150 to 200 Rev. Per Min.



AJAX  
Corliss Four-Valve Engine, Inertia  
Shaft Governor. Rotative Speed  
200 to 250 Rev. Per Min.

For further information and details send for Catalogue

## HARDIE-TYNES MANUFACTURING COMPANY

BIRMINGHAM, ALA.

CORLISS ENGINES, AUTOMATIC ENGINES, HOISTING ENGINES, DIRECT-CONNECTED ENGINES, SLIDE VALVE ENGINES, BAROMETRIC CONDENSERS, AIR COMPRESSORS, SPECIAL MACHINERY, HEAVY CASTINGS.

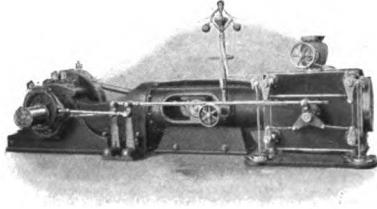
Several types of Corliss Engines are built to meet the requirements of all classes of manufacturing and public service plants.

All similar parts are interchangeable. Materials are those best suited for the service for which they are intended. Workmanship is of that high order found only in a well organized plant building high grade machinery.

Bulletins illustrating them may be had on application.

### HEAVY DUTY CORLISS ENGINES

Tangye Frame Type

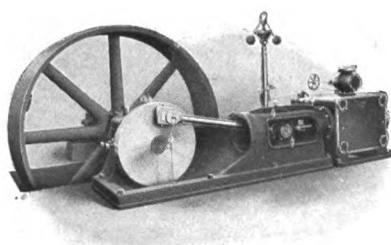


Designed for steam pressures of 150 lb. or more, to run at moderate speeds.

Built for either direct-connected or belted service, in sizes ranging from 16 x 36 in., 114 i.h.p., to 34 x 60 in., 1255 i.h.p.

### HEAVY DUTY CORLISS ENGINES

Imperial Frame Type



These engines are also designed for steam pressures of 150 lb. or more, but may be operated at somewhat higher rotative speeds than the Tangye Frame Machines.

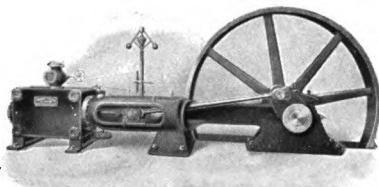
They are particularly desirable for electric power and lighting plants, requiring comparatively small powers. Sizes range from 8 x 20 in., 21 i.h.p., to 22 x 30 in., 550 i.h.p.

## HARDIE-TYNES MANUFACTURING COMPANY

### HEAVY GIRDER FRAME CORLISS ENGINES

These engines are especially suitable for manufacturing plants having moderate steam pressures and no suddenly applied overloads.

Designed for steam pressures of 150 lb. or less, and built in sizes ranging from 12 x 24 in., 52 i.h.p., to 26 x 48 in., 780 i.h.p.



### COMPOUND CORLISS ENGINES

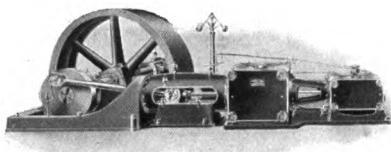
#### Cross and Tandem Types

Cross and Tandem Compound Engines are built on either Tangye, Imperial or Girder Frames, in the following sizes:

Tangye Frames 16 and 36 x 36 in., 400 i.h.p., to 34 and 68 x 60 in., 2300 i.h.p.

Imperial Frames 8 and 16 x 20 in., 65 i.h.p., to 22 and 44 x 30 in., 700 i.h.p.

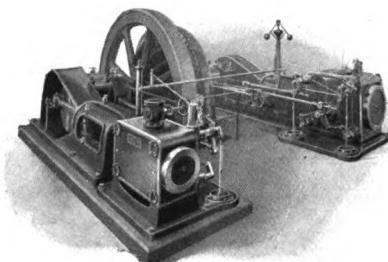
Girder Frames 12 and 24 x 24 in., 135 i.h.p., to 26 and 52 x 48 in., 1300 i.h.p.



### DIRECT-CONNECTED CORLISS ENGINES

Both Tangye and Imperial Frame Engines are built for service with direct-connected generators.

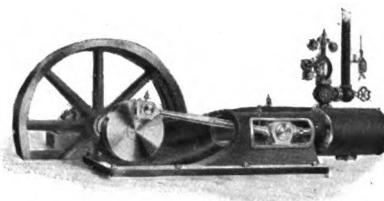
Sizes and speeds are suitable for generators ranging in power from 50 kw. to 1500 kw.



### BALANCED VALVE ENGINES

#### Heavy Duty Type

In many industries, such as saw mills, coal mines, etc., waste material is available for fuel, and the question of economy gives place to that of simplicity and low first cost.



In such cases our heavy duty balanced valve engine is a most satisfactory power producer. In design of frame, bearings, and reciprocating parts, it resembles the highest type of Corliss engines more nearly than its competitors.

Twelve single cylinder sizes ranging from 10 in. x 14 in., 39 i.h.p., to 24 in. x 30 in., 455 i.h.p.

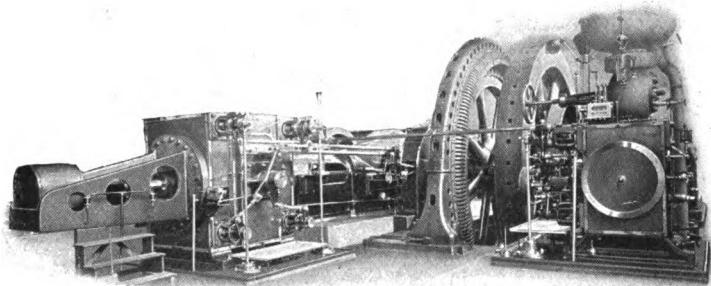
Twelve twin cylinder sizes ranging from 10 in. x 14 in., 78 i.h.p., to 24 in. x 30 in., 910 i.h.p.

## Steam Engines

# THE HOOVEN, OWENS, RENTSCHLER COMPANY

HAMILTON, OHIO

CORLISS ENGINES, SLOW AND MEDIUM SPEED WITH RELEASING GEAR; CORLISS HIGH SPEED ENGINES WITH NON-RELEASING GEAR; HIGH DUTY PUMPING ENGINES; HAMILTON POWER PUMPS; AIR AND GAS COMPRESSORS.



Cross-Compound Direct-Connected Corliss Engine

### HAMILTON CORLISS HEAVY DUTY ENGINES WITH ONE-PIECE FRAME FOR DIRECT CONNECTION TO GENERATOR OR BELT DRIVE FOR HEAVY MILL SERVICE.

Scientifically designed to meet the severest demands of modern practice; built for high steam pressures and greater rotative speeds than customary, equipped with sensitive governor, insuring extremely close regulation. Every line suggests rigidity and stability.

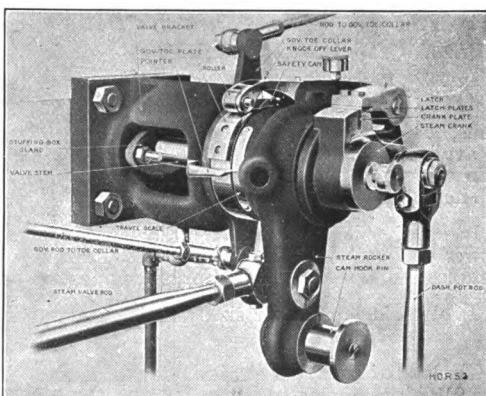
Steam and exhaust passages in the cylinders are very large, permitting low steam velocity, indicator cards showing horizontal admission and exhaust lines; volumetric clearance small, reducing steam consumption. Steam and exhaust mechanism are usually operated by separate eccentrics, giving long range cut-off. Valves double ported and motion of all parts small, consistent with good practice.

The valve gear as shown is of the releasing gravity type and is compact and simple, having very few parts. It operates noiselessly and positively at speeds up to and including 160 RPM and being a gravity gear the latch drops into place without the necessity of springs. The parts subject to stresses, such as latch and cam levers, are steel forgings, absolutely safe against breakage, and the entire valve gear is carried close to the cylinder, avoiding excessive overhang.

Frame is of the Rolling Mill type and cast in one piece; it has a broad footing on the foundation for its entire length and extends around and under crank disc.

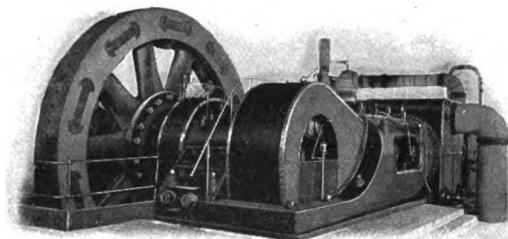
Special tools are used for machining large castings, such as cylinder or frame, at one setting, insuring perfect alignment.

We build our heavy duty and high speed engines in both the horizontal and vertical single cylinder or compound design.



Hamilton Corliss Gravity Valve Gear

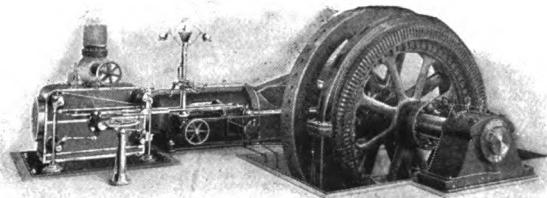
# THE HOOVEN, OWENS, RENTSCHLER COMPANY



Tandem Compound Corliss Rolling Mill Engine

## TANDEM COMPOUND HAMILTON HIGH SPEED CORLISS ENGINE WITH VARIABLE SPEED VALVE GEAR

This engine is equipped with positive driven valve gear and link motion with variable speed hand regulating cut-off mechanism and is arranged for direct connection to centrifugal pump or blower. It is provided with a fly ball governor, attached to a quick closing auxiliary throttle valve. The frame used in this engine is of same design as our heavy duty engine and the speed is usually from 125 to 175 RPM.



Single Cylinder Direct-Connected Corliss Engine

## SINGLE CYLINDER AND COMPOUND HAMILTON HIGH SPEED CORLISS ENGINE WITH NON-RELEASING VALVE GEAR

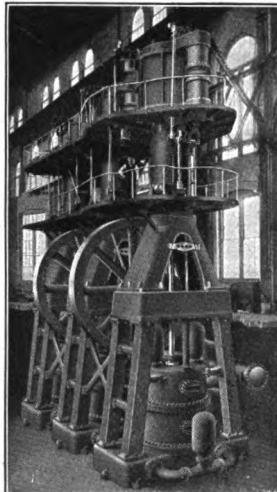
This engine is adapted for all speeds from 125 to 200 RPM. It is made from our regular Corliss patterns, with changes in the valve gears to meet the demand for higher speeds than are possible with the releasing gear and dash pots.

This engine is entirely in a class by itself and is different from the so-called "four valve engine." The valve movement is as near the regular Corliss movement as it is possible to make, without a hook and dash pot release. The mechanism is such that the valves move during the balanced period, giving highest economy and least wear. The rocker arms, etc., are as light as possible consistent with strength, reducing inertia forces to a minimum.

The valve stems are equipped with special spherical metallic packing of our own design (patented), eliminating the use of stuffing boxes. The entire valve gear sets close to the cylinder, as shown in the illustration.

The governor used on this engine is of the shaft type (patented) and is different from any other manufactured. It is arranged so that the governor weights, springs and eccentrics are in perfect gravity balance at all speeds, making it possible to equalize the steam distribution in each end of the cylinder. Another feature of importance is that the spring is attached to the weight in such a manner that its force and the centrifugal force of the weight are nearly opposite, making the resultant force and the wear on the weight pin very small indeed.

Every detail of our engines receives great care and is fully described in our bulletins issued at frequent intervals.

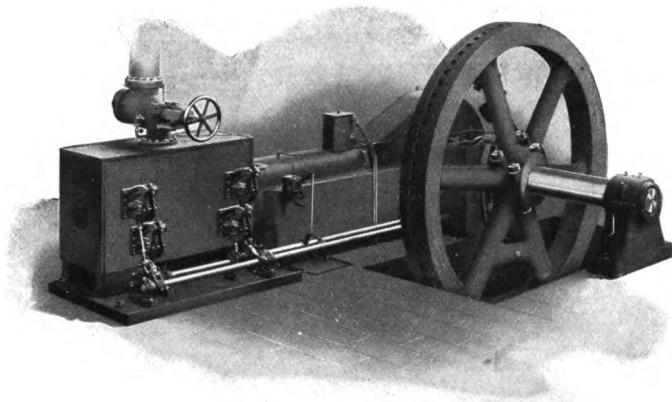


23 Million Gallon High Duty Pumping Engine

## McINTOSH & SEYMOUR CO.

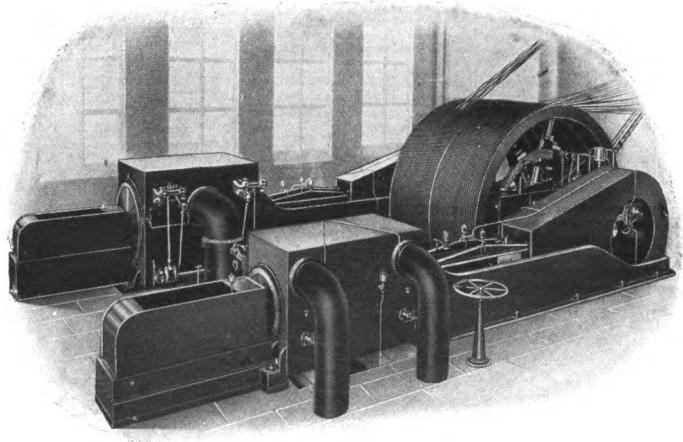
AUBURN, N. Y., U. S. A.

MANUFACTURERS OF GRIDIRON VALVE STEAM ENGINES IN ALL STYLES. SINGLE-CYLINDER, COMPOUND, OR TRIPLE EXPANSION TYPES



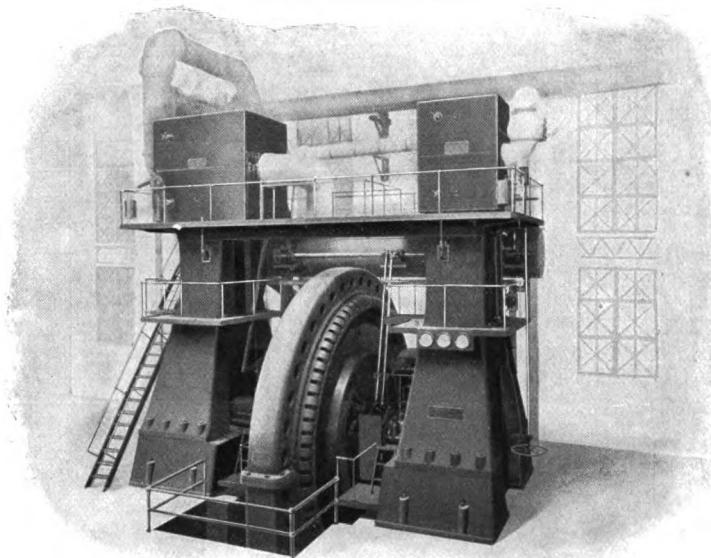
Type F Horizontal Engines. 150 to 1200 H. P.

This is a modern, positive-feed self-oiling, enclosed type of engine recently introduced with marked success. The extreme simplicity is the result of improvements suggested by twenty years' experience in building gridiron valve engines. This makes the engine less expensive and also makes it desirable to extend the range of sizes to smaller powers and higher speeds without sacrificing any of the advantages of this type in the line of sustained economy, durability, and good running qualities.

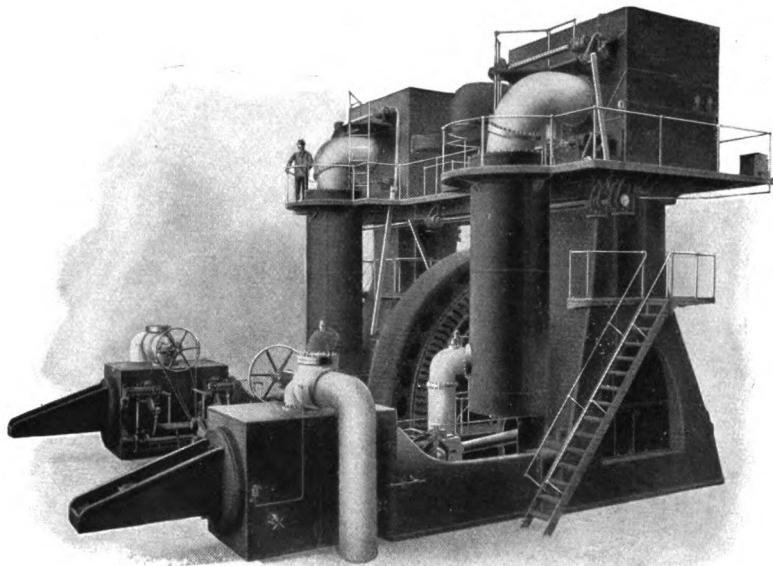


Horizontal Engines. 250 to 4000 H. P.

## McINTOSH & SEYMOUR CO.



Vertical Engines. 250 to 4500 H.P.



Combined Horizontal-Vertical Engines. 750 to 9000 H.P.

This is a patented type of engine which possesses peculiar advantages for many locations, and also where very large units are desired.

Also Horizontal High Speed Piston Valve Engines of from 25 to 500 H.P.

## THE MURRAY IRON WORKS CO.

BURLINGTON, IOWA

BUILDERS OF CORLISS ENGINES; PUMPING ENGINES; AIR COMPRESSORS;  
FEED WATER HEATERS; BOILERS; AND CONTRACTORS FOR COMPLETE POWER  
PLANTS.

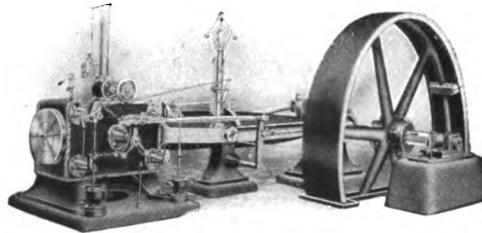
### MURRAY CORLISS ENGINES

Murray Corliss Engines are built either with girder frames, tangye frames, or rolling mill frames of our patented design. The Standard Murray Corliss is a girder-frame engine built in capacities ranging from 50 to 600 indicated horsepower. Tandem and cross-compound engines are built for any load required.

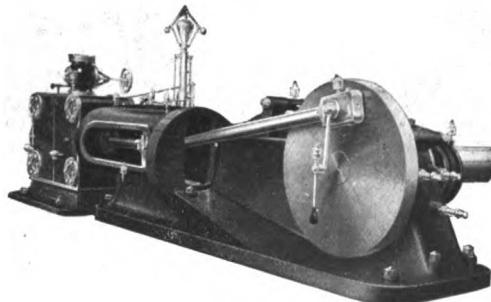
### CONSTRUCTION DETAILS

Material and workmanship are of the best and inspection is most rigid at every stage of construction. Governor is of high-speed ball-bearing type, with improved safety stops. Cylinder has exhaust passages insulated from cylinder by dead air space. Valves, valve motion, dash pots and piston are all of improved patterns. Fly wheels made in halves, free from initial strains. Pillow block vertically adjustable with oil-retaining rim.

Broad pyramidal main bearing and cylinder feet or sole plates. Connecting rod and cross head are of improved pattern and the clearance volume has been reduced to a minimum. Many working parts are ground.



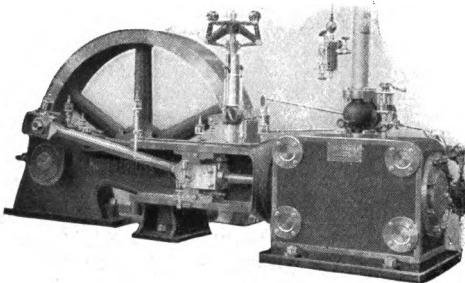
Standard Murray Corliss Engine



Murray Rolling Mill Type Engine

**MURRAY-MINOR CORLISS ENGINE—20 to 50 H. P.**

Suitable for day loads in small electric plants and for the smaller mills and factories

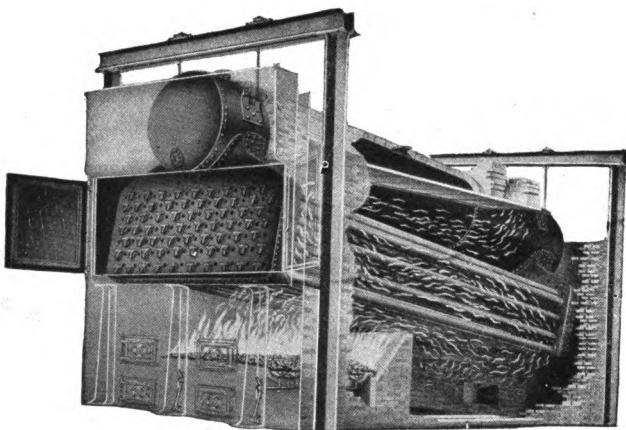


**MURRAY SAFETY WATER TUBE BOILER**

Our boiler consists of one or two top drums with front and rear headers all entirely constructed of boiler plate, with a number of wrought tubes connecting the headers. The drums incline to the rear, and headers are carefully and strongly riveted to drums, the tubes being expanded into both headers.

Free circulation of water and steam is provided for by having all connections of ample size. An internal mud drum is provided for removing impurities from the water, this drum being provided with necessary blow-off cocks. Our boilers are inspected and insured by boiler insurance companies.

The setting is designed upon proved lines of construction which an ordinary mason can execute properly. Murray rocking grates are furnished.



**Murray Water Tube Boiler**

# THE NORDBERG MFG. COMPANY

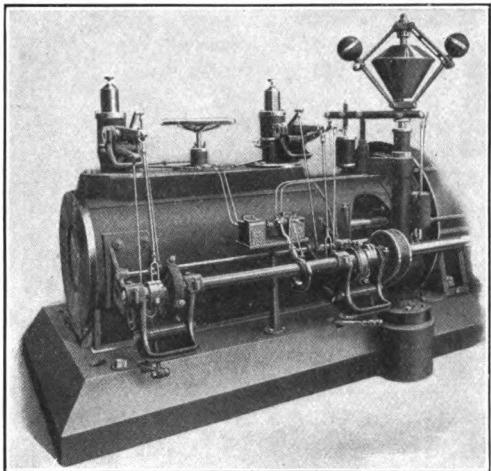
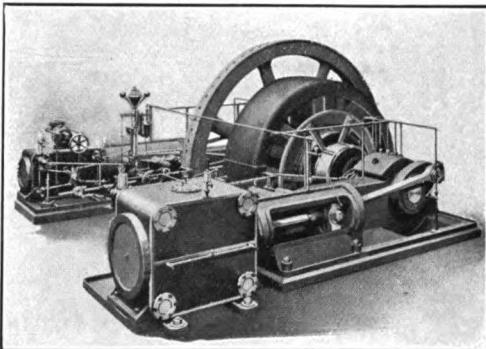
MILWAUKEE, WIS.

ENGINEERS, DESIGNERS AND BUILDERS OF

HIGH EFFICIENCY CORLISS ENGINES, UNIFLOW ENGINES, POPPET VALVE ENGINES,  
AIR COMPRESSORS, BLOWING ENGINES, HOISTING ENGINES, PUMPING ENGINES,  
STEAM STAMPS AND SYMONS DISC CRUSHERS.

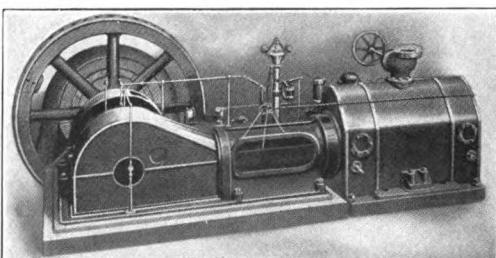
**CORLISS ENGINES:** This Company builds a complete line of the highest grade Corliss Engines of standard design and also Nordberg full stroke Corliss Engines (cut-off up to 8/10 of stroke under full control of governor), high speed Corliss Engines and heavy duty Corliss Engines.

Nordberg Engines are built in horizontal, simple, duplex, tandem compound, cross compound and vertical types; for driving electrical machinery, for belt drive, rope drive and general power purposes, and for combination with compressors, blowing engines, pumping engines, etc.



**NORDBERG EQUILIBRIUM POPPET VALVE ENGINES:** This Company has manufactured poppet valve engines for over 20 years. The fundamental advantage of the poppet valve engine is its ability to use steam at high pressures and high superheat, secondly a poppet valve remains steam tight for an indefinite period. This is demonstrated by a recent test on the famous Champion Copper Co. Compressor (which holds the world's record for steam economy). The high pressure cylinder which receives steam at 250 lbs. pressure is fitted with Nordberg Equilibrium Poppet Valve gear. A short time ago the full steam pressure was turned on the cylinder, and not the slightest trace of steam could be noticed in the exhaust, demonstrating fully the absolute tightness of the valves, even after eight years of service.

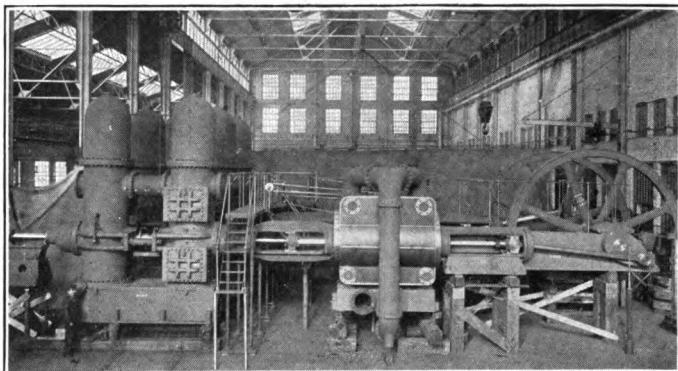
**NORDBERG UNIFLOW ENGINES:** The Uniflow Engine, invented over 25 years ago, has been developed in Germany, largely by Prof. Stumpf, and in this country, a Uniflow Engine to meet American conditions, has been designed by Mr. B. V. Nordberg, and over 150 tests under all steam conditions have been made. The primary advantage demonstrated by these tests is the enormous overload capacity of the Nordberg Uniflow Engine with flat steam consumption curve. By actual comparison with the performance of the best known types of American Turbines, the Nordberg Uniflow Engine not only has a lower steam consumption curve, but the percent increase in steam consumption with underloads is also far less than with the turbine.



*We are building complete Nordberg Uniflow Engines, and also equipping existing engines with Uniflow cylinders.*

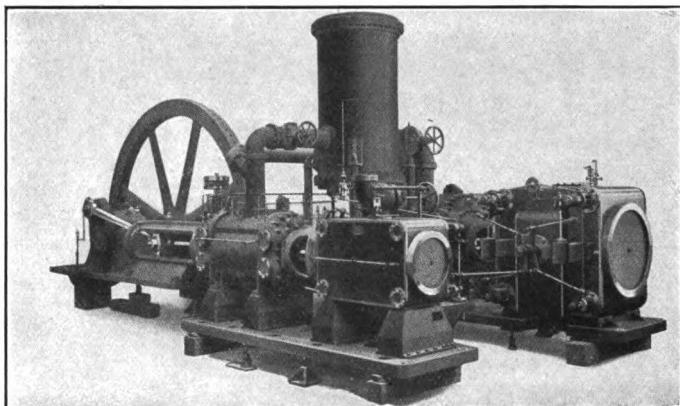
## Pumping Engines, Air Compressors, Hoists

### THE NORDBERG MFG. COMPANY

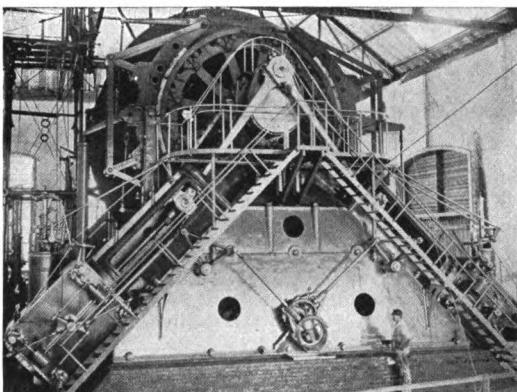


**NORDBERG PUMPING ENGINES:** The photograph shows a Nordberg Pumping Engine, built for the Utah Copper Company, capacity 10,000 gallons per minute against 265 ft. head.

The Nordberg Mfg. Company builds the highest duty compound, triple and quadruple expansion pumping engines with or without the Nordberg regenerative feed water heating system with which the highest steam economies in the world have been obtained.



**NORDBERG COMPRESSORS:** The above photograph shows a Nordberg horizontal cross compound two-stage full Corliss Air Compressor. Besides full Corliss Compressors, which are built in the largest sizes and have shown, for example at the Champion Copper Co. Mine, the highest recorded steam economy in the world, the Nordberg Mfg. Company also build a line of small compressors ("SC" Type) in capacities from 300 ft. up for belt drive. The compressors are compactly designed, fool-proof, enclosed and self-contained with automatic lubrication.



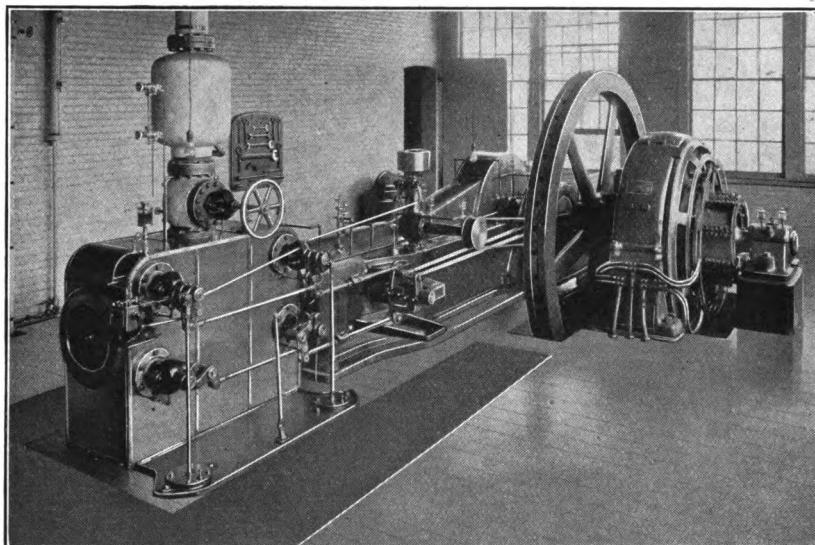
**HOISTS:** This photograph shows the largest hoist in the world, furnished to the Tammarack Mining Co., Mich.

Other products of this Company include Nordberg Steam Stamps, Symons Disc Crushers, Blowing Engines, Condensers, Vacuum Pumps and special machinery.

# PROVIDENCE ENGINEERING WORKS

PROVIDENCE, R. I.

RICE & SARGENT STEAM ENGINES. REPAIRS TO IMPROVED  
GREENE ENGINES. SPECIAL MACHINERY.



The Rice & Sargent Corliss Engines are built in all usual types, for all purposes for which a high grade Corliss engine is required. They are built in all sizes, from 150 Horse Power to the largest desired. They are designed throughout for speeds considerably higher than are usual for other Corliss engines, making them especially suited to direct-connected electrical work.

Rice & Sargent Corliss Engines are built in one grade only—The same patterns, material and workmanship are used on every engine as on those installed in some of the country's finest steam plants.

Remarkable results have been obtained in a number of very accurate tests both as regards steam consumption, regulation and mechanical efficiency.

Bulletins describing the details of construction and the result of tests will be sent to anyone.

## TROY ENGINE &amp; MACHINE CO.

TROY, PENNSYLVANIA

STEAM ENGINES OF THE CENTRE-CRANK TYPE EXCLUSIVELY

Our standard products are given in the list below. Column B gives the maximum usual pressure and Column C the number of sizes made.

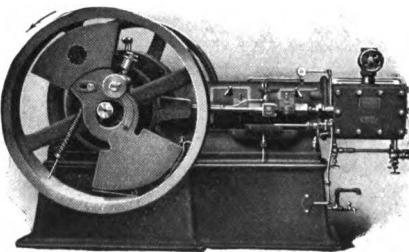
Stock Title	B	C
Troy Vertical Automatic Engines . . . . .	80-160	13
Troy Horizontal Automatic Engines . . . . .	80-160	8
Troy Vertical Direct-Connected Engines . . . . .	80-160	13
Troy Horizontal Direct-Connected Engines . . . . .	80-160	8
Troy Vertical Throttling Engines . . . . .	80-160	14
Troy Horizontal Throttling Engines . . . . .	80-160	9
Troy Vertical Low-Pressure Engines . . . . .	10- 40	10
Troy Horizontal Low-Pressure Engines . . . . .	10- 40	6

All the above are made either enclosed and self-oiling, or open with gravity lubrication.  
Sizes — 2 to 100 H. P.

## TROY SELF-OILING ENGINES

Troy Self-oiling Engines have been tested at Cornell University, disclosing high mechanical efficiency and a very low rate of water consumption. These are features of practical interest to the purchaser for they insure an important saving in the cost of operation.

This excellent showing is due to the original design of the engine, as well as the skill and care exercised in its manufacture. The engines



Horizontal Automatic Type  
for Belted Service

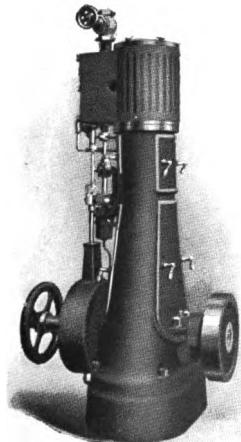
are built to give long service with minimum expense for maintenance.

The Troy Engine has—

A self-oiling system that saves oil and relieves the engineer of many duties necessary for the ordinary engine. The system has a pump and a check valve that are always dependable.

A balanced valve that is steam tight and self-adjusting to prevent leakage. This valve will not have to be replaced or repaired.

- There are other features of interest and all are described in an engine catalogue. We shall be glad to furnish complete data relative to any of our engines that may interest you. An opportunity will be appreciated to explain what the Troy Engines will do for you and how they will save you money on your investment.



Special Type of Vertical Throttling  
for D. C. to Fan or Blower

ROBT. WETHERILL & CO., Inc.  
CHESTER, PENNA.

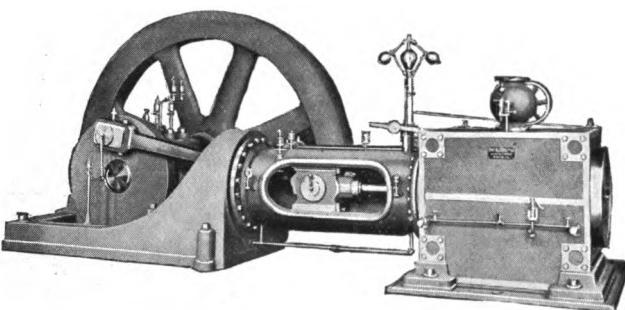
Established 1872.

CORLISS RELEASING GEAR ENGINES

All sizes, and special design for any condition of work.

CORLISS PUMPING ENGINES

ELEVATORS, Passenger and Freight, Hydraulic Plunger.



CONSTRUCTIONAL FEATURES

**Cylinders** are made of best quality iron, having *hard* close-grained wearing surfaces. The steam ports are large and direct, with large exhaust openings, and have the smallest clearances consistent with safe operation. The valve seats are bored out perfectly true with special tools and the valves accurately fitted.

**Self Packing Piston.** Piston head, special design and ribbed, giving the required strength with about one-half the weight, thus reducing the wear on bottom of cylinders. Rings are cut in segments lapping each other, to break joints. Elliptic German silver rings are attached to each segment. Their elasticity remains intact, as they are not affected by the heat, and do not corrode.

**Valve Gear.** Gravity Releasing Gear for rotative speed up to 200 R.P.M. This has been reduced to the simplest form; all parts are exposed to view and accessible while the engine is in operation. Its operation is quiet, quick and sensitive, with no appreciable effort on the part of the governor in making detachment for all points of cut off.

**Guides.** Bored type, having ample strength to resist all strains without deflection.

**Engine Frame.** Heavy duty tangye type, with broad bearing surfaces to rest on foundations.

**Guides.** Bored type, having ample strength to resist all strains without deflection.

**Main Bearing.** In four parts. Wedge adjustment used throughout, with interlocking liner plates. Lined over entire surface with Babbitt metal. Provided with suitable channels for lubrication and for draining off oil.

RANGE OF SIZES AND POWER.

Corliss Engines are built in consistent sizes ranging from 50 H.P. to 3,000 H.P. Simple non-condensing, and Compound.

Estimates will be furnished for constructing special engines for any service.

## DE LAVAL STEAM TURBINE CO.

TRENTON, N. J.

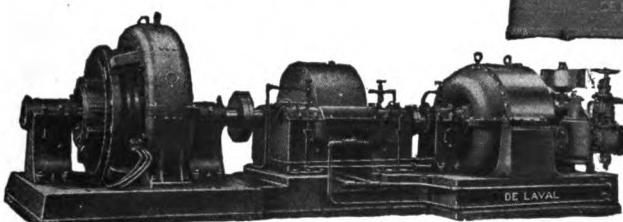
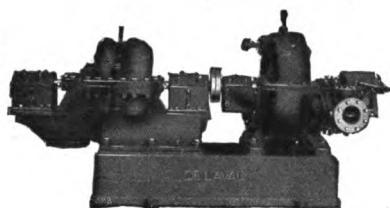
STEAM TURBINES, SINGLE AND MULTI-STAGE, FOR ALL SERVICES. CENTRIFUGAL PUMPS, SINGLE-STAGE AND MULTI-STAGE, FOR ALL CAPACITIES AND ALL HEADS. CENTRIFUGAL BLOWERS AND AIR COMPRESSORS, AND SPECIAL CENTRIFUGAL MACHINERY.



De Laval Steam Turbines are built for direct connection to alternators and other high speed machinery, and also in connection with the De Laval Speed Reducing Gear for driving standard-speed, direct-current generators, centrifugal pumps, centrifugal blowers, and for rope and belt drives; also for driving paper

machines, rolling mills, hoists and other slow and moderate speed machinery.

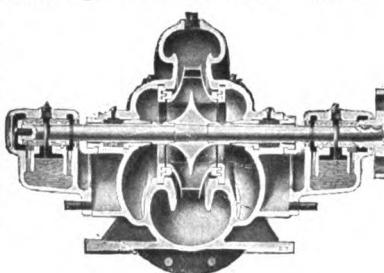
The De Laval Single-stage Steam Turbine is the most efficient of all turbines for the range of sizes from 5 H.P. to 600 H.P. One and the same turbine can be fitted with nozzles for any steam conditions. Send for Catalog A.



The De Laval Multi-velocity-staged Steam Turbine gives high efficiency in non-condensing, back pressure or low pressure service.

By reason of the multiple stages, it may be applied without gears to the direct driving of small direct-current generators, centrifugal pumps and blowers, etc. All internal parts are accessible upon lifting the casing cover, and without disconnecting steam or exhaust piping. All wearing parts, such as blades, guide vanes and nozzles, are easily replaced at small expense. Send for Catalog F.

De Laval Multi-stage Turbines are of the "multi-cellular" type, consisting of a series of DeLaval Wheels in separate chambers. Through using the proper turbine speeds, made possible by the gear, the number of stages, the length of shaft and complexity have been minimized. The wheels are enclosed in an impenetrable steel armor. These turbines are built in all sizes above 500 H.P. Write for Catalog D.



De Laval Centrifugal Pumps are built in both single-stage and multi-stage types and with horizontal and vertical shafts and in all capacities and for all heads. De Laval Centrifugal Pumps are distinguished by the fact that all wear-

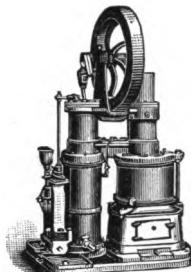
ing parts are removable and replaceable, including bearings, shaft sleeves, impellers, labyrinth packing rings, etc. All internal parts may be removed upon lifting the casing cover, and without disconnecting suction or discharge piping. Send for Catalog B.



## RIDER-ERICSSON ENGINE COMPANY

NEW YORK    BOSTON    PHILADELPHIA    MONTREAL  
SYDNEY, AUSTRALIA

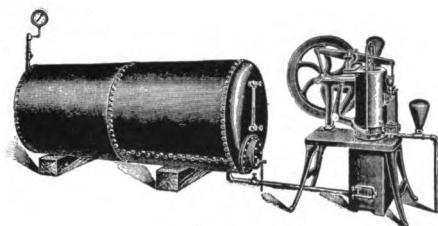
"REECO" RIDER HOT-AIR PUMPING ENGINES. "REECO" ERICSSON HOT AIR  
PUMPING ENGINES. "REECO" ELECTRIC PUMPS.



"Reeco" Rider Hot-Air Pumping Engine

### THE "REECO" RIDER HOT-AIR PUMPING ENGINE

Is especially adapted for somewhat heavy domestic work where water has to be pumped from deep wells or forced to a great height. It uses every kind of solid and liquid fuel. More than 20,000 in operation.



"Reeco" Ericsson Hot-Air Pumping Engine

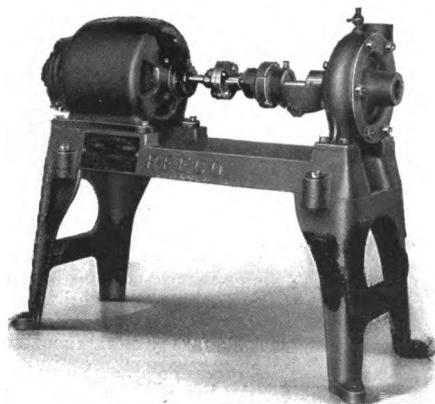
### THE "REECO" ERICSSON HOT-AIR PUMPING ENGINE

(Invention of Captain John Ericsson)

Is especially adapted for lighter work such as pumping for seashore or suburban cottages, hotels, etc.

About 30,000 in operation.

The simplest known form of power pump. Uses all kinds of liquid and solid fuel.



"Reeco" Centrifugal Pump, Motor and Belt Drive.  
(Legs shown in cut are used only in connection with  
1" motor driven pump.)

### THE "REECO" CENTRIFUGAL PUMP

Made for both motor and belt drives, provided with outboard, ring-oil bearings, with removable bushings and flanged machined couplings.

Catalogues in English, French, German, Portuguese and Spanish.

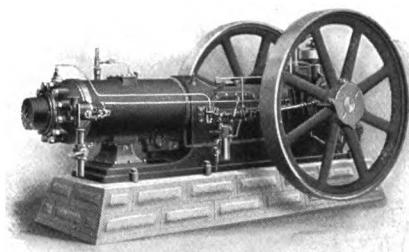
# THE BESSEMER GAS ENGINE CO.

GROVE CITY, PA.

BUILDERS OF BESSEMER CRUDE OIL ENGINES, BESSEMER GAS ENGINES, BESSEMER KEROSENE ENGINES, BESSEMER DIRECT GAS ENGINE DRIVEN AIR AND GAS COMPRESSORS, BESSEMER DIRECT DRIVEN PUMPS, BESSEMER BELT DRIVEN COMPRESSORS, BESSEMER REVERSE CLUTCHES. BUILDERS OF COMPLETE POWER PLANTS.

## THE BESSEMER GAS AND CRUDE OIL ENGINES

2 H. P. to 350 H. P.



The Bessemer Crude Oil Engine, Single Cylinder.

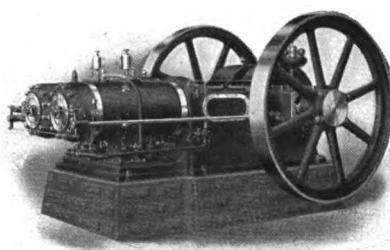
throttling governor used, a regulation not peculiarly adapted to electric light and power work or any installation in which steady operation is a factor.

Bessemer Crude Oil Engines operate on crude oil, fuel oil, solar oil, and low gravity distillates. They are engines without magnetos, sparkers or batteries and operate smoothly and continuously without depositing carbon in combustion chamber.

Bessemer Engines are entirely distinct and different. They are built with enclosed crank case, with a crosshead, obviating the wear on cylinder which occurs in the trunk piston type of engine; have no valves exposed to the force and heat of exploding gases, hence no regrinding or valve troubles; splash and mechanical force feed lubrication, direct geared throttling governor, extra heavy and strong parts, wide adjustability for wear, making a strictly high grade engine that is securing the gas engine business wherever introduced.

Bessemer Engines are not experimental, there being over 11,000 in daily use. Single cylinder, twin cylinder and twin cylinder opposed types.

Send for catalogues, Blue Book of Bessemer Buyers and ask to be placed on mailing list to receive the Bessemer Monthly and Monthly Art Calendars as issued.

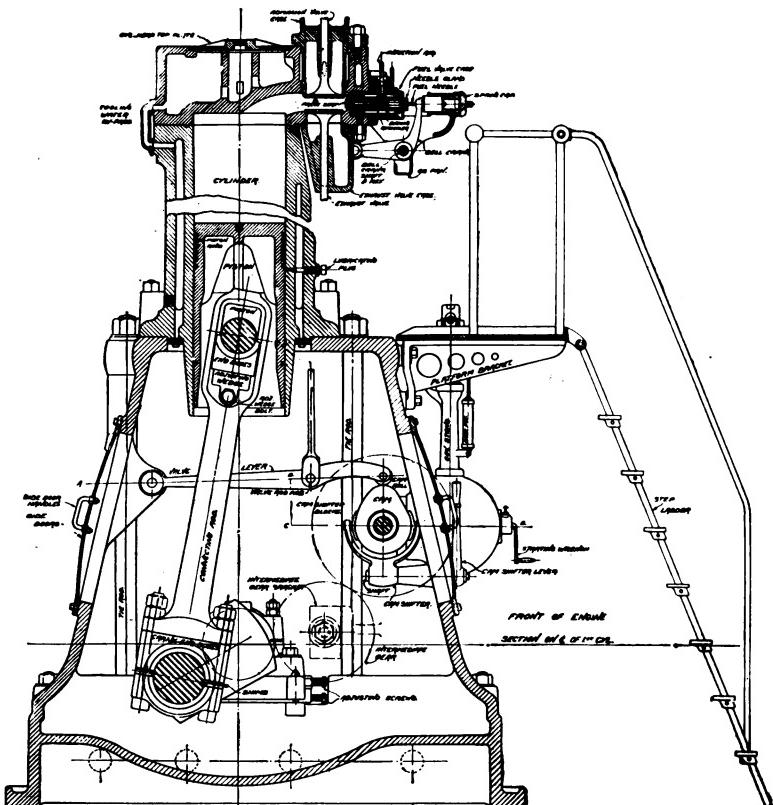


Twin Cylinder Bessemer Gas and Crude Oil Engine

# BUSCH-SULZER BROS.—DIESEL ENGINE COMPANY

ST. LOUIS, MO.

THE DIESEL ENGINE MANUFACTURERS



These engines are the most economical prime movers known.  
Use crude or cheapest grade fuel oils or distillates.

Do not require heating up to start.

Have no electric or hot tube igniters.

Combustion gradual—no explosion; smooth running and evenness of speed thereby secured.

Fuel fed automatically from fuel tank into combustion chamber and amount injected governed by load on engine.

Start cold and pick up full load in a few minutes—stopped as readily—cut out stand-by losses.

None of the auxiliaries of steam or gas producer plants.

Operate in parallel alternating or direct current generators.

# BUSCH-SULZER BROS.—DIESEL ENGINE COMPANY

ST. LOUIS, MO.

THE DIESEL ENGINE MANUFACTURERS

Our Diesel Engines produce power at lower cost than any known prime mover; for instance, will develop electric current at 1-2 cent or less per Kilowatt Hour; pump water at 2-10 of a cent per 1,000 Gallons at 50 pounds pressure and make ice at 18 cents a Ton.

Sold under the broadest kind of guarantee.

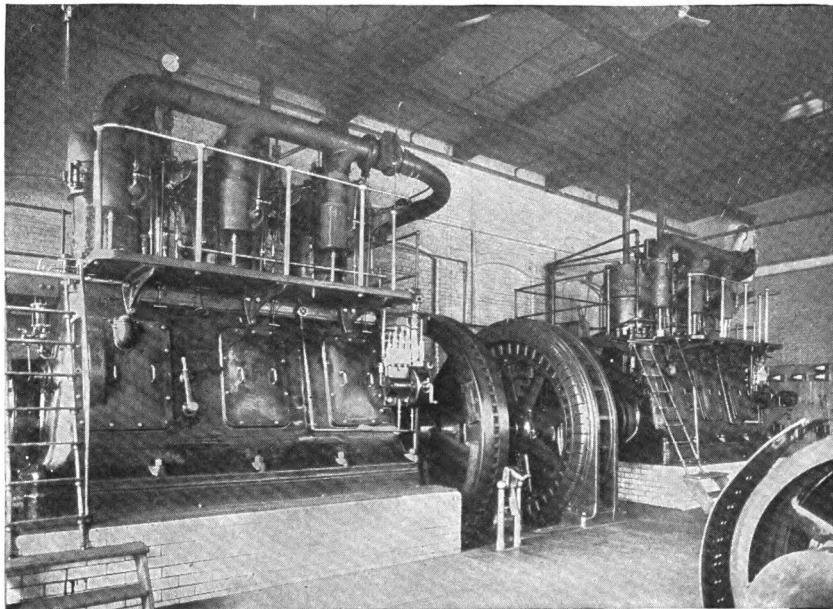
Economize space. No coal yards, bins, ash dumps or fuel handling space needed. Less building to keep up and pay taxes on or more space for factory, warehouse or shipping room.

No smokestacks—no smoke, soot or dirt—most clean and sanitary power plant built.

Over 100 satisfied users in the U. S. will tell you about the Busch-Sulzer Bros.—Diesel engine.

Write for details, cost of installation, operation and tests.

By agreement with Dr. Diesel this company has exclusive right to his inventions, improvements and advisory engineering services for the U. S. and Canada.



Diesel Engine Plant, Gorham Mfg. Co., Providence, R. I.

## AUGUST MIETZ IRON FOUNDRY & MACHINE WORKS

123 MOTT ST.,

NEW YORK

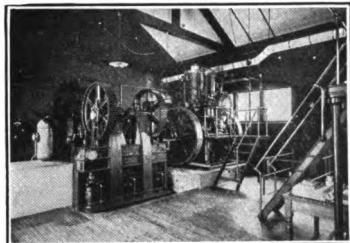
OIL ENGINES, MARINE AND STATIONARY, DIRECT COUPLED OR BELTED TO  
GENERATORS; AIR COMPRESSORS; PUMPS; HOISTS.

### THE MIETZ & WEISS OIL ENGINES

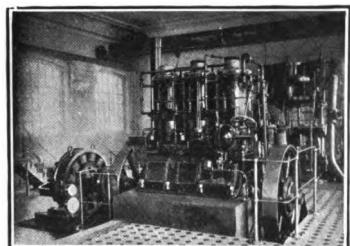
Stationary and Marine, 2 to 600 h.p. Direct Reversible Marine Engines

75 to 600 h.p.

Over 200,000 h.p. in Operation

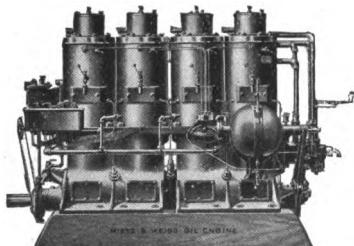


These engines are operated at moderate compression pressures and medium speeds, consuming approximately one gallon of crude oil or other fuel per ten horsepower hours, at a cost of three cents. The smaller sizes generally run with kerosene.



They are two-cycle heavy duty engines, extremely simple, and, equipped with our steam cooling system, the reliability and durability is equal to the modern steam engine. The steam generated in the water jacket of the cylinder enters the combustion space and is compressed with the charge.

They are used for all power purposes, pumping and electric light plants either direct or belted to generators, operating in parallel.



The Direct Reversible Marine Engines are rigidly connected to the propeller shaft, without fly wheel and fitted with the S & W Air Distributor. They are controlled by a lever to stop or start the engine in either direction by compressed air through most reliable and positive mechanism.

## DE LA VERGNE MACHINE CO.

1123 EAST 138TH STREET

NEW YORK CITY

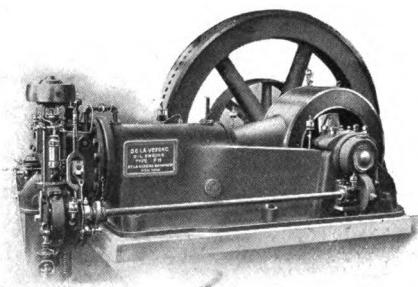
DE LA VERGNE CRUDE OIL ENGINES  
GAS ENGINES                  ICE MACHINES

### TYPE "FH" CRUDE OIL ENGINE

#### GUARANTEED:

To operate on the cheapest and heaviest grades of petroleum and crude oils, including those from the California and Texas fields with an asphaltum base.  
 To deliver the full rated Brake Horse Power not only at sea level but up to 5000 ft. altitude.  
 To consume not more than the following quantities of fuel per BHP hour:—

When running at $\frac{3}{4}$ to full load.....	0.6 lbs.
"        " at $\frac{1}{2}$ to $\frac{3}{4}$ "	0.65 "
"        " at $\frac{1}{4}$ to $\frac{1}{2}$ "	0.75 "



#### Operates at medium pressures.

Not more than  $1\frac{1}{2}$  gallons of lubricating oil per 1000 BHP hours ordinarily required.

Not more than 3 gallons of cooling water necessary per BHP hour.

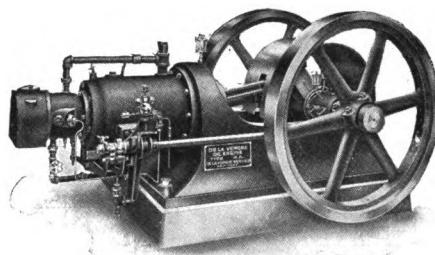
Reliable and satisfactory service with minimum expense for upkeep.

Manufactured in sizes of 90 HP. and over.

Type "FH" engines aggregating 15000 HP. in operation.

Detailed information in bulletin No. 112.

### TYPE "HA" OIL ENGINE



#### GUARANTEED:

To operate satisfactorily on ordinary grades of distillates and fuel oils. To deliver the full rated Brake Horse Power. To consume not more than the following amounts of fuel per BHP hour:

When running at full load.....	1 lbs.
When running at $\frac{3}{4}$ load.....	1.12 "

When running at  $\frac{1}{2}$  load..... 1.35 "

In sizes from 10 HP. to 100 HP.

For detailed information see bulletin No. 111.

Both types are adapted to and used in all classes of service where reliability is of importance in addition to

**Low Cost of Operation.**

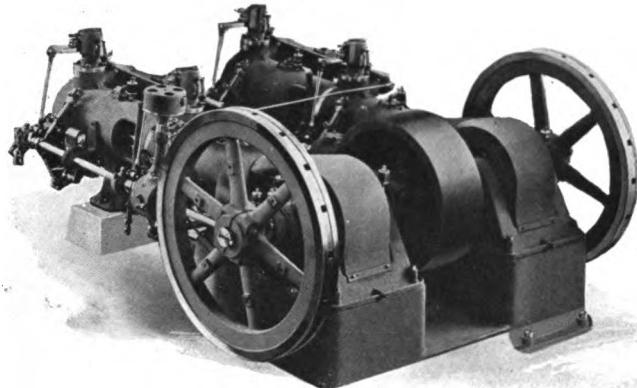
## Gas and Gasoline Engines

# THE ELYRIA GAS POWER CO.

ELYRIA, OHIO

### GAS ENGINES

Builders of "The Little Big Engine"



#### FEATURES OF "THE LITTLE BIG ENGINE"

Uses Producer, Natural and City Gas, Gasoline and Distillate.

Only change necessary in change of fuel is length of connecting rod for altering compression and exchange of fuel handling devices.

Economy ranges from 10,000 to 12,000 BTU, depending on size.

All sizes with water-cooled exhaust valves; all but No. 2 have water-cooled pistons and piston rod. No water joints subject to explosion pressures.

Governs by varying lift of inlet valves. Good regulation.

Pulley or flexible coupling bolted to flywheel, either side.

Ignition make-and-break or jump spark, both for continuous service.

Our "Show-me" guarantee means much to the buyer. Get it.

Crank Shaft half of cylinder bores. Main bearings removable bushings.

Automatic Air Starting Equipment always included.

Gas Producers and Dynamos furnished. Quick delivery a feature.

Engineers can safely use for estimate figures \$80 per H. P. in smallest to \$60 per H. P. in largest sizes. This includes engine and anthracite producer, delivered and fully installed above foundations.

We deal with purchasers or Engineers only. We have no Agents.

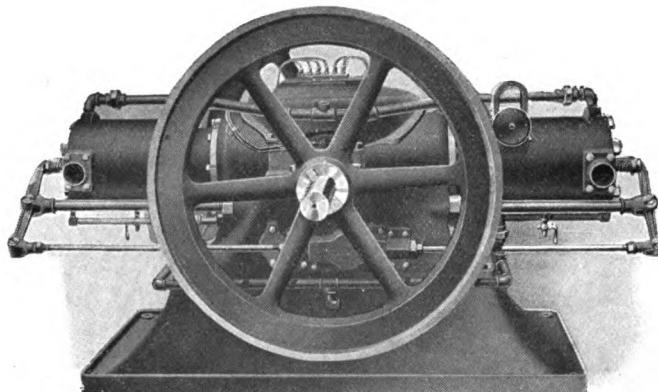
#### APPROXIMATE RATINGS AND FLOOR SPACE

FUEL	Compre- ssion	ENGINE NO. 2		ENGINE NO. 3		We twin the No. 4 and No. 5				
		H.P.	R.P.M.	H.P.	R.P.M.	H.P.	R.P.M.	H.P.	R.P.M.	
Natural Gas.....	140 lbs.	40	325	60	290	75	275	110	260	
		30	250	45	220	60	225	85	200	
City Gas.....	125 lbs.	40	325	60	290	75	275	110	260	
		30	250	45	220	60	225	85	200	
Gasoline or Dis- tillate.....	75 lbs. to 100 lbs.	35	325	55	290	70	275	100	260	
		30	275	45	240	60	235	85	220	
Gasoline or Dis- tillate with Water	100 lbs. to 125 lbs.	40	325	65	290	80	275	120	260	
		30	325	45	290	55	275	85	260	
Producer Gas....	160 lbs. to 180 lbs.	25	275							
Over all space		5'-0" x 10'-0"		11'-6" x 5'-7"		12'-6" x 6'-0"		14'-0" x 6'-10"		
						Twinned 12'-6" x 11'-6"		Twinned 14'-0" x 13'-6"		

# THE HEER ENGINE COMPANY

PORTSMOUTH, OHIO

HIGH GRADE GAS AND GASOLINE ENGINES  
Stationary, Portable and Traction



For all general stationary power purposes this engine is our standard type, adapted to mills, factories, workshops, mines, electric lighting plants, and in fact, any place where absolutely steady and reliable power is required.

## THE HEER TWO CYLINDER OPPOSED ENGINE

When it is desired to develop power in units of from 5 to 100 H. P. the two cylinder opposed type of gas or gasoline engine gives better satisfaction at less expense for room, fuel, and attendance than any other prime mover.

The Two Cylinder Opposed requires no excess weight to hold it in place—its perfect balance and evenness of construction retains its equilibrium and requires absolutely no re-adjustment when moved to another location. In the elimination of vibration there is naturally a saving of its energy, thus developing greater power at a lesser cost.

Another very important feature and advantage of the Two Cylinder Opposed is the securing of practically two engines in one or an emergency plant in case one cylinder gets out of order or needs repairing for any cause; it can be disconnected instantly without loss of time and the engine will run indefinitely on one cylinder. This is a very valuable feature which any user of power will appreciate.

## CONSTRUCTIONAL FEATURES

*Four Cycle Operation* conceded most economical of fuel.

*Mixer or Carburetor* a combination, if desired can be used for gas or gasoline, and changed from either fuel to the other without stopping the engine.

*Fuel* may be natural or manufactured gas, gasoline, California distillate, kerosene, solar oil, or Oklahoma distillate.

*Ignition* is Jump Spark, the simplest and most reliable.

*Speed* is controlled by governor and can be changed as desired.

*Power and Test.* A brake test is given each engine, and all engines are rated at less than their brake horse power.

## DIMENSIONS OF STATIONARY TYPES

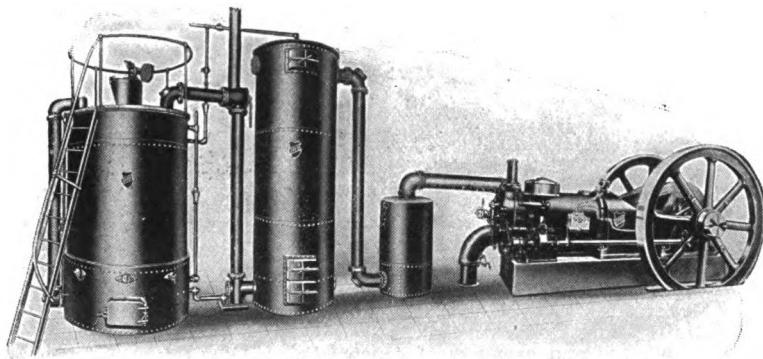
SIZE OF ENGINE IN RATED HORSE POWER	10 H. P.	16 H. P.	25 H. P.	40 H. P.
Bore of Cylinder.....	5"	6"	7"	9"
Stroke.....	5	6	7	10
Diameter of Crank Shaft in Pins and Bearings.....	2	2 $\frac{3}{8}$	2 $\frac{3}{4}$	4
Crank Shaft Extended on One End for Pulley.....	6	8	10	12
Full Length of Crank Shaft Regular.....	31 $\frac{1}{8}$	37 $\frac{1}{8}$	43 $\frac{1}{8}$	57 $\frac{1}{8}$
Full Length of Crank Shaft Extended both ends.....	36 $\frac{1}{8}$	44 $\frac{1}{8}$	52 $\frac{1}{8}$	68 $\frac{1}{8}$
Length of Base at Bottom.....	40	46 $\frac{1}{4}$	53 $\frac{1}{2}$	66
Width of Base at Bottom.....	20	23	26	34
Length of Engine over all.....	50 $\frac{1}{8}$	59 $\frac{1}{8}$	68 $\frac{1}{4}$	99 $\frac{1}{2}$
Width of Engine over all Regular.....	31 $\frac{1}{8}$	37 $\frac{1}{8}$	43 $\frac{1}{8}$	57 $\frac{1}{8}$
Diameter of Fly Wheels.....	26	30 $\frac{1}{2}$	35	48
Pulley any size up to (Larger Size Extra).....	14	16	24	30
Revolutions per Minute (Normal).....	600	500	450	350
Total Weight of Complete Engine.....	800	1300	2200	5200
Style Number.....	20	21	22	23

Write for Catalogue.

## THE OTTO GAS ENGINE WORKS

HOME OFFICE AND WORKS, PHILADELPHIA, PA.  
NEW YORK CHICAGO KANSAS CITY

"OTTO" ENGINES ARE DESIGNED TO OPERATE ON CITY OR NATURAL GAS, PRODUCER GAS, GASOLINE, DISTILLATE AND ALCOHOL. ADAPTED FOR ALL POWER PURPOSES—PUMPING PLANTS—STATIONARY AND PORTABLES, HOISTING RIGS, HIGH AND LOW VOLTAGE ELECTRIC LIGHTING PLANTS. DIRECT-GEARED AIR COMPRESSORS. STATIONARY AND PORTABLES. HEAVY DUTY ENGINES FOR MANUFACTURING INDUSTRIES.



Otto Suction Gas Producer and Latest Throttling Governor Engine

### THE OTTO SUCTION GAS PRODUCER

The "Otto" Suction Gas Producer converts the heat of anthracite coal, charcoal, or coke into producer gas or semi-water gas, containing a certain amount of carbon monoxide and hydrogen, and having a heating value of approximately 130 to 140 B.T.U. per cu. ft. The loss due to purifying and cooling of the gas, etc., is only about 20 per cent, so that 80 per cent of the total heating value of the fuel is available for power or heating purposes, as against about 15 to 20 per cent in the average steam plant.

The complete producer consists of three cylindrical tanks; one being the producer proper containing the fire and carrying at the top the evaporator or moistener; the second is the scrubber filled almost to the top with coke, and the third is the gas receiver which acts as a small storage tank for the finished gas.

All precautions have been taken to make "Otto" Gas Producers and Gas Engines absolutely safe and reliable and they are listed and approved by the National Board of Underwriters.

### ECONOMY

When using coal of suitable quality the fuel consumption is *guaranteed* not to exceed  $1\frac{1}{4}$  lb. per brake h. p. per hour during full load runs. Actual practice has shown considerably more favorable results, as we have records of many large plants operating on less than one lb. per h. p. hour.

"Otto" horizontal engines are built in all sizes from 4 to 300 h. p.

Bulletins No. 10 and 24 furnish complete information. Mailed upon request.

## THE ST. MARYS MACHINE CO. ST. MARYS, OHIO

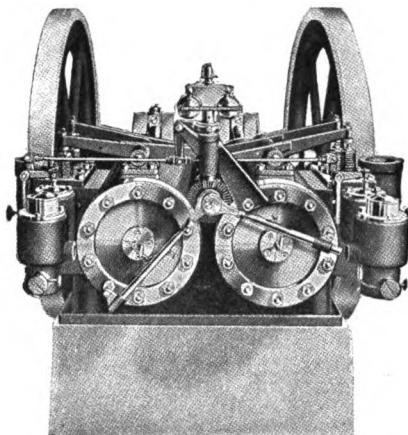
OIL ENGINES AND SUCTION GAS PRODUCERS; HEAVY-DUTY TANDEM ENGINES;  
SINGLE-CYLINDER SOLAR OIL AND DISTILLATE ENGINES; PORTABLE ENGINES;  
TRACTION ENGINES. ENGINES FOR EVERY POWER PURPOSE.

### HEAVY-DUTY TANDEM GAS ENGINE Maximum Size 480 h.p.

This engine operates on the four-stroke cycle. There are two cylinders arranged tandem, each having one single-acting piston. The two pistons are connected by a water-cooled piston rod, the front piston serving as a cross-head carrying the wrist pin, and but one connecting rod and crank is necessary as the pistons move together. This engine lends itself to various combinations for increasing the power of a plant.

### DUPLEX SOLAR OIL ENGINES 50 h.p. up to 150 h.p.

This engine is designed for use with natural gas, city gas, gasoline, distillate, solar and crude oils, and is of the throttle-controlled type. An impulse is obtained at each revolution, resulting in greater steadiness.



The regulating device on these engines consists in vertical balanced valves which are moved by the governor and actuated by levers. The air and gas valve areas are proportioned to supply gas and air in the proper proportions to form an inflammable mixture of constant quality in any quantity that the governor may demand.

The lay shaft, igniter, eccentric, governor and pump are common to both cylinders. Each cylinder has its own regular mixing chamber attached directly to throttling chamber, doing away with long intake pipes that cause a governor to operate so sluggishly. This insures the correct amount of mixture in both cylinders, and at no time is the explosion greater in one cylinder than in the other or than

the horse power required, hence a steady power.

### SINGLE-CYLINDER SOLAR OIL ENGINES 10 h.p. up to 90 h.p.

These engines operate on the four-cycle plan and are designed to embody every feature calculated to insure the greatest strength and symmetrical appearance of the engine.

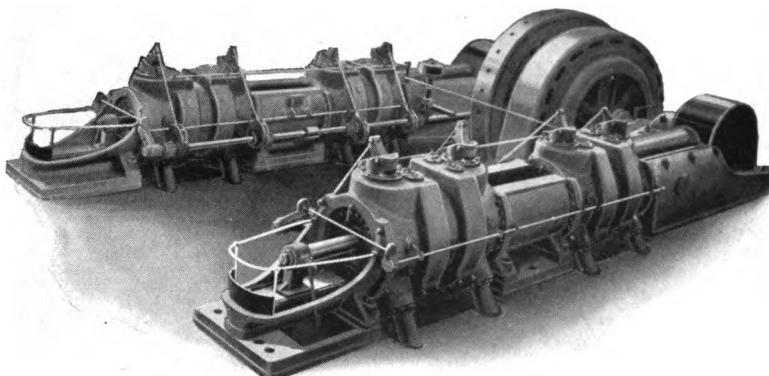
## THE WISCONSIN ENGINE CO.

CORLISS, WISCONSIN

COMPLETE PLANTS

GAS      OIL      STEAM

ADAMS WISCONSIN GAS ENGINES. ADAMS WISCONSIN KEROSENE GAS ENGINES.  
WISCONSIN HIGHER SPEED CORLISS ENGINES. PRODUCERS TO FIT THE FUEL:  
ANTHRACITE, BITUMINOUS, LIGNITE, OIL PRODUCERS.



1500 KW Unit

### ADAMS WISCONSIN GAS ENGINE:

Standard Sizes 150 KW to 1500 KW.

Simple, reliable and suited to any gas.

With these engines we furnish "Producers to fit the Fuel."

### WISCONSIN ANTHRACITE PRODUCER:

An up-draft producer with angle of repose grates, adapted to economical use of smaller sizes of anthracite fuel.

### WISCONSIN BITUMINOUS PRODUCER:

A down-draft producer with water seal base, automatically stoked with compressed mixture, makes no tar, can be operated continuously.

### WISCONSIN LIGNITE PRODUCER:

An up-draft producer with angle of repose grates. Special arrangements to utilize the lighter lignite tars.

### WISCONSIN OIL PRODUCER:

A down-draft producer forming a clean fixed gas from lowest grade crude or fuel oils; forms a low hydrogen gas, free from tar.

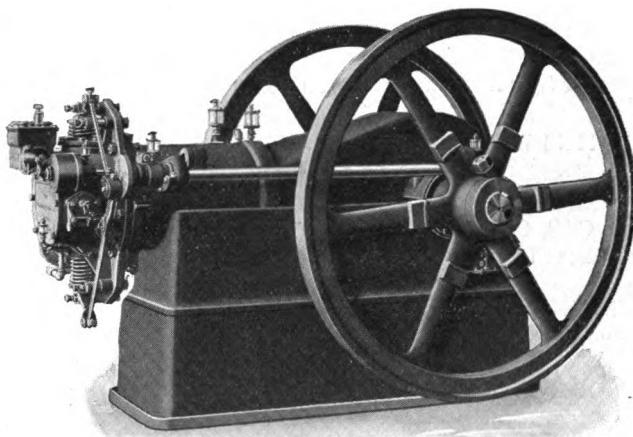
## THE WISCONSIN ENGINE CO.

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ANTHRACITE, BITUMINOUS, LIGNITE, OIL PRODUCERS.



### ADAMS-WISCONSIN KEROSENE GAS ENGINE

Capacity 50 BHP to 200 BHP. Built under Rumely patents. Gasifies and uses kerosene, gas oil, naphtha or gasoline. All these oils are gasified in a cold carburetor exactly as gasoline is gasified. 200,000 HP now in use.

### WISCONSIN HIGHER SPEED CORLISS ENGINE

A heavy duty engine, built in capacities 100 HP to 12,000 HP, for all purposes. Highest efficiency for those who demand the best. Bulletin C-4 tells the details.



The Badger Engine Jack turns an engine over. Uses steam or compressed air. Get the story—Ask for Bulletin C-5.

## THE GAS MACHINERY CO.

CLEVELAND, OHIO, U. S. A.

COAL AND WATER GAS APPARATUS EXHAUSTERS, CONDENSERS, SCRUBBERS,  
TAR EXTRACTORS, WASHERS, PURIFIERS, VALVES, CONNECTIONS,  
BY-PRODUCT MACHINERY, COMPLETE GAS PLANTS.

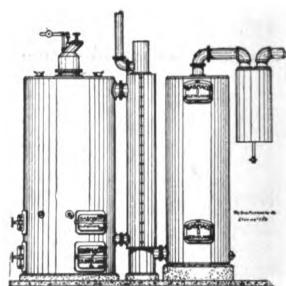
### GASMACO

Our business is so largely concerned with specific requirements of individual Gas Companies that a catalogue of our products is hardly feasible; but we issue a large number of Bulletins in which special features and various applications of our products are fully illustrated and described.

BULLETINS DESCRIBING THE FOLLOWING WILL BE SENT  
ON REQUEST

- I. COAL-GAS, OIL-GAS, and CARBURETTED WATER-GAS PLANTS for illuminating or fuel purposes.
- II. AMMONIA APPARATUS for making aqua-, anhydrous- or concentrated ammonia.
- III. TAR STILLS.
- IV. GAS VALVES "Cone Disc" all iron Double Gate Valves, Angle Valves and Gas Connections.
- V. BLUE-WATER-GAS-PLANTS for welding, brazing, etc.

- VI. GAS PRODUCERS for small anthracite coal, made in sizes from 35 H. P. to 300 H. P. for fuel and power purposes.



Gas Producer

- VII. MUFFLE FURNACES for enameling, direct or producer-gas fired, with recuperators to save a large amount of the heat in waste gases.

- VIII. BRICK KILNS, continuous tunnel kilns.

# STANDARD GAS POWER COMPANY

149 TREMONT ST., BOSTON, MASS.

"AKERLUND" BITUMINOUS, ANTHRACITE, AND FURNACE GAS PRODUCERS, AND THE "LEGG" CONTINUOUS BRICK KILN

POWER, LIGHT, HEAT, WITHOUT SMOKE

This Producer uses successfully all grades of bituminous coal (including mine roof slabs, mine slack or culm, and low grades of coal that cannot be used for steam), lignite, coke, wood, peat, etc., and delivers a pure, clean gas to the engine.

Installations in constant successful operation during the past four years have thoroughly satisfied our customers in regard to our claims as to RELIABILITY, EFFICIENCY and SIMPLICITY of DESIGN and OPERATION.

No complicated mechanism, and no mechanical scrubbers or feeders; no grates—therefore, ashes can be removed without interfering with operations; no moisture regulators or thermostats, since our by-pass poppet valve arrangement automatically regulates gas production and fuel consumption proportionately to engine load.

Nothing can get out of order if given ordinary care.

Longevity as a satisfactory working proposition becomes self-evident to any engineer the moment he completes his examination—all of which is summed up in MAXIMUM ECONOMY.

In sizes up to 150 H.P., "Akerlund" gas producers are guaranteed not to exceed a pound and a half of coal per brake horse-power hour from half to full load, and in actual operation consume on an average not over one pound. In sizes above 150 H.P., the consumption of coal is less. No fuel is charged to the usual layover periods—the fire being in banked condition as soon as engine is shut down—only waste gases escaping through stack.

Only fifteen to thirty minutes are required for starting of plant after twelve to twenty-four hours layover.

While an intelligent and interested operator will naturally get the best and most economical results, the "Akerlund" producers can be and are being successfully operated by men who have had no special technical training, such as firemen and ordinary laborers.

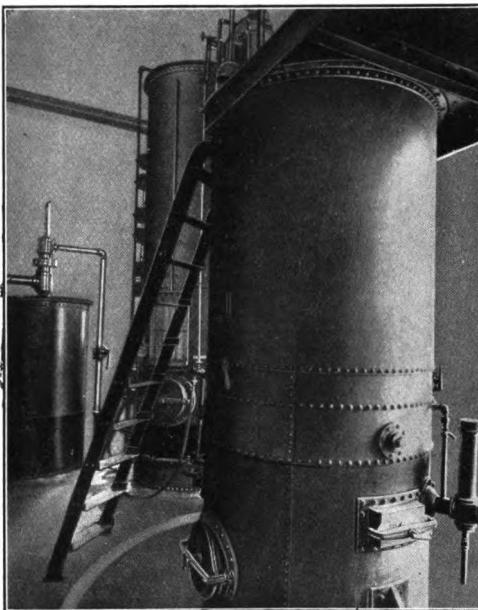
With any steam plant, neglect or mistakes generally cause an explosion. With the "Akerlund" producer the only damage would be that the gas supply might be cut off.

## PRODUCER GAS FIRED CONTINUOUS KILN.—Legg System.

Our gas fired continuous kilns have proven during actual operation to be the most efficient, economical, durable and convenient kiln for brick, tile, terra cotta, pottery, etc., and are absolutely smokeless.

Actual results in a going plant are what count. We can show a plant in which the fire was started in September, 1911, and has never been out, the producer having been available twenty-four hours per day, turning out daily some thirty-five thousand, ninety-eight per cent perfect brick.

COMPLETE INFORMATION ON REQUEST.



Akerlund Bituminous Gas Producer supplying gas for electric lighting and pumping station, installed near Atlanta, Ga., by Fulton County Government.

# THE SMITH GAS POWER COMPANY

LEXINGTON, OHIO.

GAS PRODUCERS FOR POWER AND HEATING, SUCTION AND PRESSURE TYPES.  
SPECIAL DESIGNS FOR ANTHRACITE, BITUMINOUS AND LIGNITE COAL. TAR  
EXTRACTORS AND GAS CLEANING PLANTS.

STANDARD APPARATUS IS BUILT IN THREE TYPES: B, C AND E.

Type B. Built in nine sizes. From 50 H. P. to 300 H. P. for Bituminous Coal.

Type C. " " " 50 " 300 " Lignite Coal.

Type E. " " eleven " 25 " 300 " Anthracite Coal.

## SPECIAL FEATURES OF THE DIFFERENT TYPES

*Type B* Producers are up-draft equipped with mechanical scrubbers. The design is such that in usual practise the tar made is not more than 1 to 3% by weight of the coal burned.

*Type C* Producers are down-draft equipped with mechanical scrubbers. The design is such that nearly all of the volatile contained in the lignite is converted into a fixed gas. Not necessary to shut down for cleaning. One 600 H. P. plant has been in operation two years without drawing the fire.

*Type E* Producers are up-draft equipped with static baffle scrubbers.

## SPECIAL FEATURES COMMON TO SMITH PRODUCERS OF ALL TYPES

Patented automatic method of regulating the ratio of steam to air in the blast at all loads.

Flat swinging grates in smaller sizes—Shaking grates mechanically operated in larger sizes. Special facilities provided for removing ash from center of fire. Low driving rate per sq. ft. of grate area so that the temperature of the fire will not reach the fusing point of the ash.

Deep fuel bed enables the producer to respond to sudden fluctuations in load.

Large fuel magazine obviates the necessity of frequent charging.

Charging Hopper design that prevents the admission of air to the top of the producer while charging.

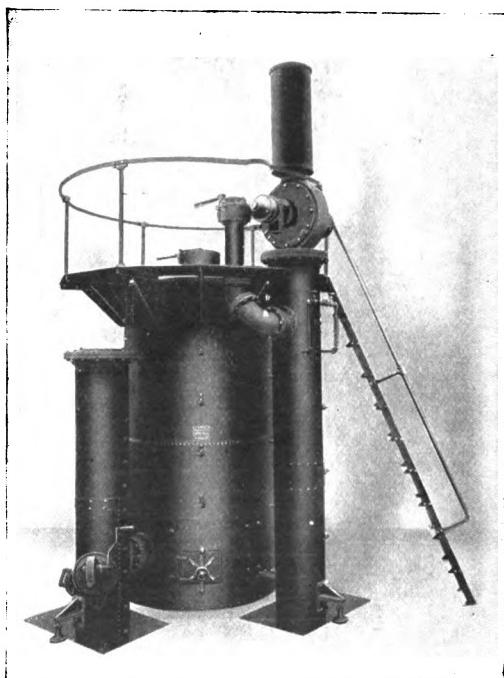
The Static Baffle Scrubber is efficient, compact, and "fool proof."

Patented self-cleaning producer gas valves.

Piping. All connections to shells are made with solid cast iron flanged saddles riveted in place. Flanged fittings are used throughout. Flanges are made up permanently, the pipe being expanded and beaded into the flanges.

Special hot water boiler placed in the engine exhaust line acts as a silencer and furnishes moisture for the blast. Extra large boilers can be furnished in case hot water is wanted for heating buildings.

Exhausters and automatic pressure regulators furnished when it is desired to deliver gas under pressure to engines or for heating.



Smith Type B Suction Producers to operate on bituminous fuel

# EDGE MOOR IRON COMPANY

EDGE MOOR, DELAWARE

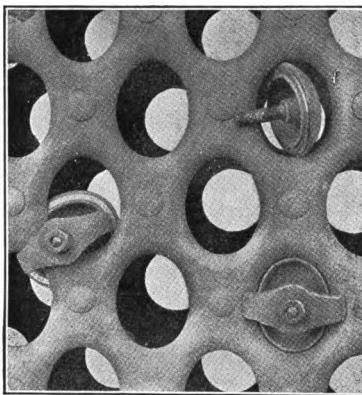
## WATER TUBE BOILERS

Manufacturers of WATER TUBE BOILERS, in four sections, consisting of front and back headers, drums and tubes. The construction of headers and their connection to drums is designed to avoid contraction of circulation at those parts.



Battery of 6 4-Drum Edge Moor Water-Tube Boilers in course of erection.  
W. Va. Pulp & Paper Mill, Covington, W. Va.

Surfaces and storage capacity is large and the boiler responds quickly to unusual demands and maintains a steady water line. Passing of gases may be arranged in several ways and any type of stoker or grate may be used. A sliding hearth plate facilitates cleaning fires. Superheaters may be connected in several ways and are designed to require little attention and no flooding. They add nothing to the width of setting. We are prepared to build boilers from 6 tubes wide up to 30 tubes wide and 6 to 16 tubes high, from 1 drum up to 5 drums and tubes 18' to 20' long. Typical Setting with 18-foot tubes has length over all of 20'10 $\frac{1}{2}$ '. Length of Furnace may vary in length from 60" to 144". Width of Furnace may vary per column A of table below. Height of Setting varies from 11'-10" up to 20'-9" overall. To determine width of setting for given H. P. add to dimension from Col. A 17" each for side walls and 26" for partition in double setting. Add 6" each side for buckstays. Tubes draw front or rear.



Exterior view of hand-hole plate of header.

TABLE GIVING RANGE OF NOMINAL H.P.  
For Different Widths of Setting

A	Horse Power	A	Horse Power
4' 5"	100 to 210	12' 1"	270 to 600
5' 0 $\frac{1}{2}$ "	115 " 240	12' 9"	285 " 630
5' 8"	125 " 270	13' 4 $\frac{1}{2}$ "	300 " 660
6' 4"	140 " 300	14' 0"	315 " 700
6' 11 $\frac{1}{2}$ "	155 " 340	14' 8"	335 " 730
7' 7 $\frac{1}{2}$ "	170 " 375	15' 3 $\frac{1}{2}$ "	350 " 760
8' 3 $\frac{1}{2}$ "	180 " 405	15' 11 $\frac{1}{2}$ "	360 " 790
8' 10 $\frac{1}{2}$ "	200 " 435	16' 7"	375 " 820
9' 6 $\frac{1}{2}$ "	215 " 465	17' 2 $\frac{1}{2}$ "	395 " 850
10' 2 $\frac{1}{2}$ "	230 " 505	17' 10 $\frac{1}{2}$ "	410 " 880
10' 9 $\frac{1}{2}$ "	245 " 535	18' 6"	425 " 915
11' 5 $\frac{1}{2}$ "	260 " 565	19' 2"	435 " 945

## HEINE SAFETY BOILER COMPANY ST. LOUIS, MO.

New York  
Cincinnati

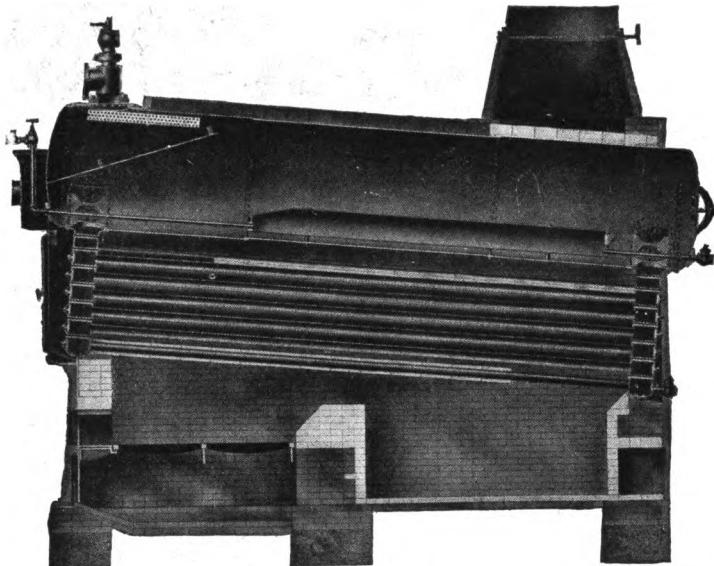
SHOPS: St. Louis, Mo. Phoenixville, Pa.

Boston  
Chicago  
Pittsburgh

Philadelphia  
New Orleans

HEINE SAFETY WATER TUBE BOILERS, HEINE PATENT STEAM SUPERHEATERS  
STEEL STACKS, HOUSINGS, FLUES, ETC.

### THE HEINE BOILER



The Heine Boiler consists of three parts: the drum or shell, the front and rear headers and the tubes.

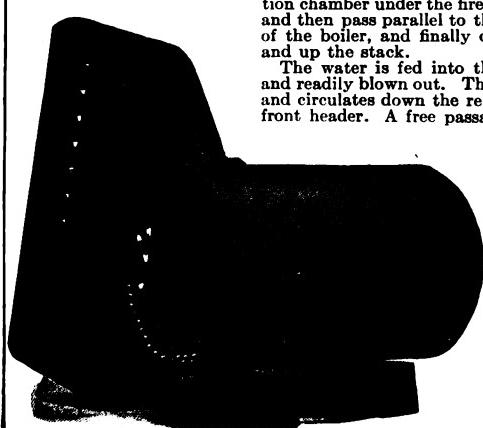
The partially consumed gases rising from the fuel bed are completely burned in the combustion chamber under the fire brick baffle placed on the lower row of tubes and then pass parallel to the boiler tubes from the rear to the front of the boiler, and finally over the upper baffle and under the shell and up the stack.

The water is fed into the mud drum where the sludge is deposited and readily blown out. The water rises out of the drum as it is heated and circulates down the rear header through the tubes and up the front header. A free passageway for the steam and water is provided

by the large throat area at the junction of the boiler shell and the headers. This construction is shown at the left and is to be contrasted with those types of boilers in which the water circulation is badly congested.

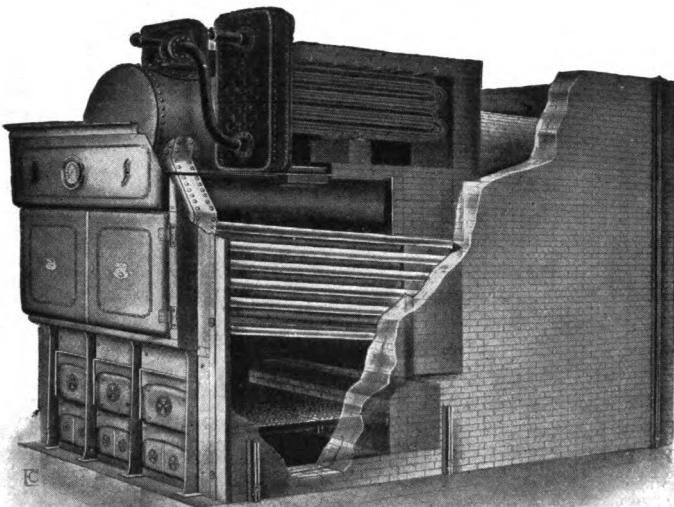
This large throat area means dry steam, because the velocity of the steam is low, and therefore its capacity for carrying water is a minimum. Dry steam is further insured by providing a separator within the boiler. The steam must make a complete turn around the deflection plate, which may be seen in the illustration and it must make another complete turn in passing through the dry pan.

For further information regarding modern boiler practice, and the efficiency of the Heine Boiler, send for "Boiler Logic" and our book "Helios."



# HEINE SAFETY BOILER COMPANY

## THE HEINE SUPERHEATER



The Heine Superheater may be installed with any type of boiler in new or old installations. It consists of a header box into one side of which are inserted U tubes made of  $1\frac{1}{2}$ " seamless, drawn mild steel tubing, expanded into holes provided for them. The interior of the box is divided into three compartments, so that the steam makes three passes through the superheater.

The Heine Superheater is designed (a) to give close regulation of superheat, (b) to permit adjustment of the degree of superheat at any time, (c) to give maximum capacity per square foot of superheater surface, and (d) to give high efficiency in utilization of heat in the fuel. (It should be borne in mind that with all types of superheaters, regardless of their construction or method of installation, the superheating is secured from the heat in the combustion gases and represents fuel burned.)

The Heine Superheater is installed above the water line and to one side of the drum, and receives its heat from a small flue built in the side wall of the setting, which carries hot gases direct from the furnace to the superheater chamber, where they make two passes around the superheater tubes. The quantity of hot gas is controlled (automatically or by hand) by a damper at the outlet of the superheater and the temperature of the steam may be regulated to within 5° of any desired figure.

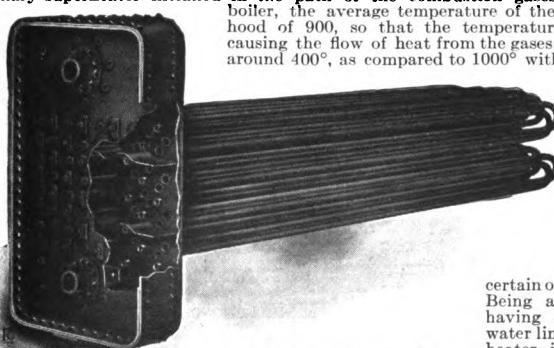
In the Heine Superheater large superheating capacity is secured, because the average temperature of the hot gases giving up heat to the superheater is about 1500°, whereas, with the ordinary superheater installed in the path of the combustion gases after the first pass of the boiler, the average temperature of the gases is in the neighborhood of 900, so that the temperature difference or heat head causing the flow of heat from the gases to the steam is somewhere around 400°, as compared to 1000° with the Heine Superheater.

As the heat transmitted through a square foot of superheater surface is proportional to the temperature difference, it follows that each square foot of Heine Superheater surface has about double the capacity of the ordinary type.

The location of the Heine Superheater has certain other important advantages.

Being above the water line and having no connection below the water line, no flooding of the superheater is necessary, and the accumulation of mud and scale on the interior surfaces of the superheater is prevented.

Furthermore, the superheater is at all times accessible for inspection and cleaning, so that the surface may be kept clean. For further details send for "Superheater Logic" and "Hehos."



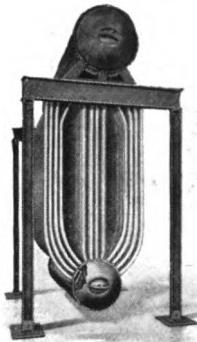
# THE MILNE WATER TUBE BOILER CO.

30 CHURCH STREET

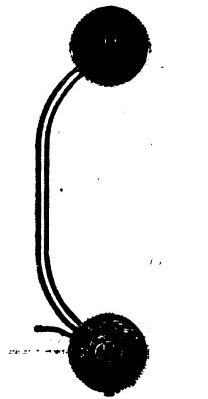
NEW YORK CITY

## WROUGHT STEEL WATER TUBE BOILERS

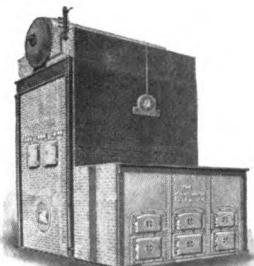
Milne System Patented



Complete boiler, suspension frame and economizer chamber



Side view of economizer



Boiler bricked in and ready for operation

**THE MILNE WATER TUBE BOILER** is a resilient construction of wrought steel throughout, and is a complete unit composed of three members only—the drums, the tubes and the economizer.

THE DRUMS are true cylinders constructed according to standard modern shop practice.

THE TUBES are uniformly shaped at each end and are interchangeable top to bottom or back to front, standing in vertical staggered rows when in position; arranged in such a way that they can be easily removed and replaced.

## ECONOMIZER AND PURIFIER

This is an exceptionally valuable feature, which not only purifies the feed water, but utilizes the waste heat to its maximum possibility, thereby economizing fuel.

It will be noted from the illustrations here shown, that about one sixth of the heating surface of the boiler is devoted to utilizing waste heat, or in other words a twenty section boiler (240 tubes) would have an economizer composed of 40 tubes.

The double rear row of tubes forming the economizer extends across the back of the boiler for the purpose of intercepting the heat in its passage to the flue, and as the feed water must pass upward through these tubes, at the rate of about one foot per minute its increase in temperature causes a precipitation of water impurities which gravitate to the economizer chamber and from this point are blown out as required.

The economizer and purifier is a composite part of the boiler and is fully described in our catalogue and bulletins which will be sent free on request.

The entire boiler set is supported on an independent suspension frame within the brick work enclosure which combines a combustion chamber with suitable entrance and cleaning doors. There are no flat surfaces, and a multiplicity of hand hole plates, stays, and other accessories required in some types of boilers are entirely eliminated.

## ADVANTAGES OF THE MILNE WATER TUBE BOILER

Maximum Fuel Economy	Natural Cleanliness
Uniform Strength	Dry Steam
Simplicity	Extremely Effective
Reduced Cost of Maintenance	Circulation or Movement
Accessibility	of the Furnace Gases
Rapid Circulation	
Large Water Storage	

Write for Catalogue and Bulletins

# E. KEELER COMPANY

Established 1864

## WILLIAMSPORT, PA.

New York

Boston

Philadelphia

Pittsburgh

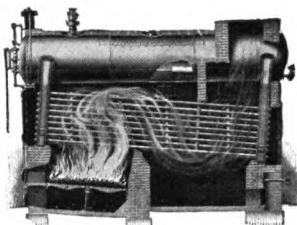
Chicago

## WATER TUBE AND TUBULAR BOILERS, STEEL PLATE WORK

### WATER TUBE BOILERS

Standard Type

The arrangement of furnace, tubes, headers and drum in the Keeler Water Tube Boiler is efficient, accessible and compact. The superior efficiency of the Keeler Boiler rests upon correct proportions of heating and grate surface for the character of fuel to be burned, ample height of furnace, a superior arrangement of baffle walls and a perfect circulation. Every portion of the heating surface is accessible for both external and internal inspection, making it impossible for soot or scale to accumulate undetected. There is ample room between tubes and drum for inspection or repairs. Special side cleaning doors make it possible to observe the condition of the outside surface of the tubes. There is no part of the interior surface that cannot be examined and cleaned.



Standard Type Water Tube Boiler

Keeler Water Tube Boilers are usually built complete and tested in the shop. This reduces the cost of erection, as the boilers are handled as a unit. It also eliminates the dangers due to careless assembling of boilers in the field and makes the erection merely a matter of placing in position and attaching fittings.

Boilers of 500 H. P. and more must be shipped in a knocked down condition. We are prepared to send erecting engineers to any part of the country to rivet the drums to the headers, expand the tubes and test.

### WATER TUBE BOILERS

Cross Drum Type

The Keeler Cross Drum Water Tube Boiler is a modification of the standard design, only in the length and location of the drum and the method of connecting it to the headers. This type was developed to meet the demand for a high grade water tube boiler that could be installed in Office Buildings, School Houses, Churches, Apartment Houses, Hotels and boiler rooms generally where ceiling height is limited or where the boiler must be introduced through narrow passageways or restricted openings.



Cross Drum Type Water Tube Boiler

The pressure parts of the boiler are shipped in a knocked down condition, making it possible to install it without cutting through walls and floors in locations that would be wholly inaccessible for almost any other type of boiler. If boilers are to be exported, the cross drum boiler can be handled at much less expense by steamship companies on account of its reduced bulk in a knocked down condition, and the comparatively small weight of the heaviest piece.

### HORIZONTAL RETURN TUBULAR BOILERS

We recommend that all Tubular Boilers except Boilers of 100 horse power and below, for low pressure heating purposes only, be built with butt strap longitudinal seams to be double, triple or quadruple riveted as required by size and pressure. No boiler of lap riveted construction should be considered for power purposes. The small saving in the cost of the bare boiler is not justified when compared with the total cost of boiler and fixtures installed. Keeler Return Tubular and Internally Fired Boilers are well and favorably known. The same care that has always been used in their construction combined with the most modern methods and equipment keeps our boilers in the class of the very best.



Horizontal Return Tubular Boiler

Ask For New Water Tube Catalogue

## JOHN MOHR & SONS

349-359 W. ILLINOIS ST.

CHICAGO, ILL.

**GARBE WATER TUBE BOILER, BLAST FURNACES, STEEL LADLES, HOT STOVES,  
CUPOLAS, FURNACES, MIXERS, CONVERTERS, STERILIZERS, ETC.**

### THE GARBE BOILER

#### Special Advantages

All handholes with their troublesome and expensive gaskets are eliminated, as the tubes are expanded into very large drums which are equipped with the patented pressed "Garbe" Plate. Any tube can easily and quickly be inserted, removed and replaced without disturbing any of the others.

Elimination of all flat surfaces, stay bolts and braces. All parts of Boiler are cylindrical and curved.

All tubes are absolutely straight and nearly vertical, therefore the entire circumference of tube is directly exposed to the gases. The effective heating surface is materially larger than that obtained by horizontal tubes.

The upper drum is suspended from a substantial structural frame work, absolutely independent from the mason work. The lower drum is in contact with two slides or guides, thereby allowing free expansion of tubes, equalizing the strain between drums and reducing chances of leakage to a minimum.

The vertical arrangement of tubes allows the steam to develop very freely and to flow by the shortest way possible without changing direction to the upper drum, thereby causing a very rapid circulation. The tubes are distributed over the full length of the Boiler, thus giving a large and uniform steam liberating surface, equal to the full area of the tubes. This vertical arrangement of tubes will do away with local overheating and consequent rupture of the tubes so often occurring in horizontally arranged tubes.

Soot, dust and ashes cannot accumulate on tubes or any part of drum, thereby allowing longer periods of operation without the necessity of cleaning.

Large water capacity, due to the extremely large size of upper and lower drum, insuring a more constant water level than any other Boiler.

The feed water passes through the rear bank of tubes, which have the lowest temperature, to the lower drum and deposits therein all impurities.

Over half of the entire heating surface is effective in liberating steam.

Practically no scale in tubes owing to rapid circulation and vertical tubes.

Further Information on Request.

# JOHN O'BRIEN BOILER WORKS CO.

ST. LOUIS, MO.

**WATER TUBE, TUBULAR, FIRE-BOX AND INTERNALLY FIRED BOILERS. IMPROVED O'BRIEN-HAWLEY DOWN DRAFT FURNACES. SMOKE STACKS, TANKS AND SHEET IRON WORK.**

## WATER-TUBE BOILERS

Design B. Vertical Baffle

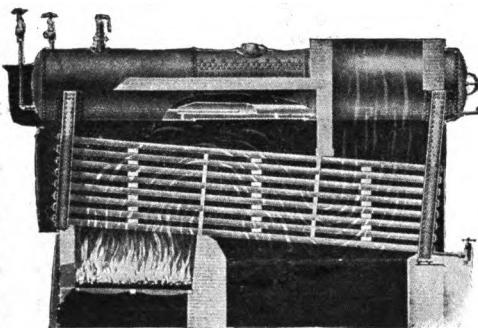
The boiler consists of one or more steam and water drums to which is securely riveted a front and rear water leg or header. The drums are perfectly level when the boiler is in position.

The tubes are expanded into the headers in straight horizontal and staggered vertical rows and are inclined 1" to the foot. A greater pitch can be had if desired. The outside diameter of the tubes is 3½".

We can furnish the 4" outside diameter tubes if specified.

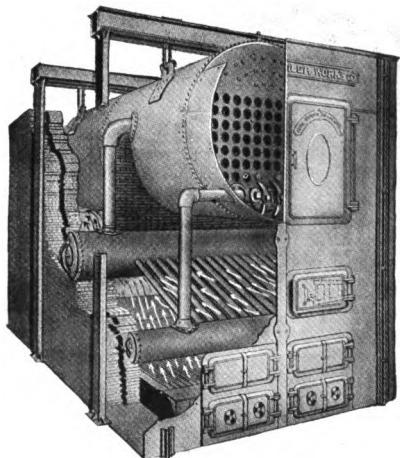
To meet all demands we build our boilers with either the vertical or horizontal baffle.

We also manufacture a water tube boiler with the drum set parallel with the tubes which, when in position, shows an incline of 1" to the foot.



## THE O'BRIEN-HAWLEY IMPROVED SMOKELESS DOWN-DRAFT FURNACE

Can be attached to any design of boiler



This furnace is constructed with two separate grates, one above the other. The upper grate is formed of a series of tubes opening at their ends into drums or manifolds through which the water of the boiler continually and rapidly circulates. The tubes form the fire grate. Air for combustion enters through fire doors near the top of the furnace.

The division wall at the back of the furnace deflects the draft down through the fire upon the upper grate and over the fire on the lower grate. The fire on the lower grate is entirely fed by coked coal falling from the upper grate and the unconsumed gases and smoke from the upper fire are efficiently burned by the lower fire.

The lower grates are of common bars accessible through flue doors for cleaning and spreading.

# THE WICKES BOILER COMPANY

SAGINAW, MICHIGAN, U. S. A.

## VERTICAL WATER TUBE BOILERS; HIGH GRADE RETURN TUBULAR BOILERS

These boilers are designed for delivering dry steam, for very easy cleaning and for high every-day thermal efficiency. The illustration gives a clear idea of the design, which consists, primarily, of upper and lower drums joined by perfectly straight boiler tubes.

The steam drum is arranged to give a height of 66<sup>1</sup>/<sub>2</sub> from water line to the dished head, upon which the steam outlet nozzle is riveted. This high drum serves several purposes. It provides room for separation from the steam of water which is always entrained with steam at a point close to the surface of liberation; it gives room for workmen to stand inside of the boiler when cleaning the tubes, and since the shell is subject to a mild degree of heat some superheat is effected upon the steam.

Two 12" x 16" manholes open this boiler, it is accessible from top to bottom for inspection and cleaning. The tubes are straight; every tube can be looked through, washed or scraped. The illustration shows a man standing erect using a turbine cleaner. Is it laborious compared with the work in other forms of boilers? Two men can open, turbine, close and fill this boiler in ten hours.

The circulation of the water is up the front tubes and down the rear. The tube area is made equal in both sets of tubes in order to provide free circulation both for water and steam. Steam pockets cannot form and the arrangement equalizes heating throughout the boiler.

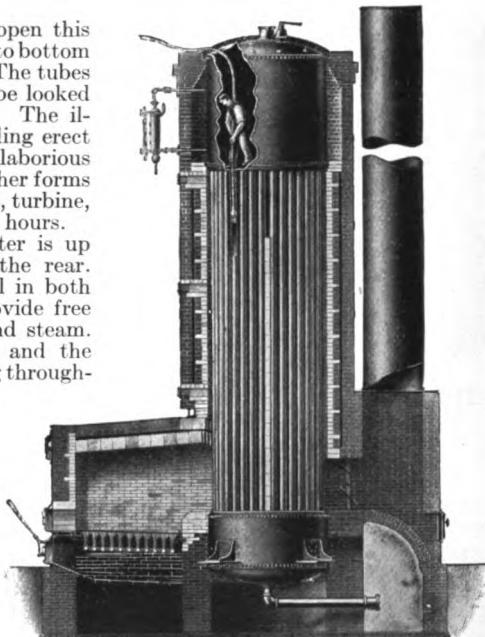
The blow-off is located at the very lowest point of the bottom of the mud drum. Feed water is usually introduced into the steam drum directly into the down-take tubes far below the water line.

The furnace is of the external oven type, the grate surface being entirely surrounded by highly heated surface in order to avoid chilling the products of combustion. Any type of stoker may be applied to the furnace.

The gases in their flow from furnace to outlet are compelled to sweep over heating surface in every foot of their travel; every foot of heating surface in the boiler is swept over by the gases in their travel. The gases are closely enough confined to the heating surface to entirely surround and cover it, as well as establish a strong scrubbing action of gas to metal. No chance for gases to short-circuit exists. No chance for gases to enter pockets in the setting unfilled with heating surface exists. A very long gas travel is provided. The design provides for the very best heat transfer by conduction and convection.

The tubes being vertical, soot and dust carried on gases and impurities precipitated from the water fall to the mud drum, where easy removal is provided for.

The boiler is constructed of the very best homogeneous steel, made by the open hearth process. The highest character of workmanship known to the art at the present day is put upon these boilers. The closest scrutiny and inspection by the best informed on this workmanship is invited and requested.



# THE BURKE FURNACE COMPANY

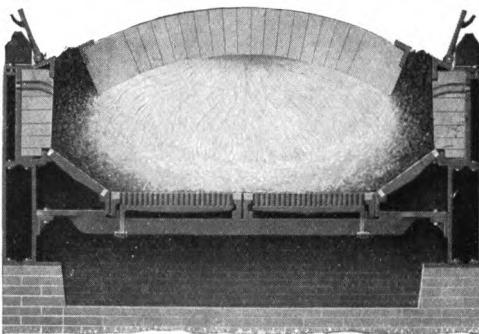
CHICAGO, ILL.

## APPARATUS FOR SMOKELESS COMBUSTION OF BITUMINOUS FUELS

Easy  
to operate

No  
complicated  
mechanism  
to  
get out  
of  
order

Adapted  
to  
all kinds  
of  
Boilers,  
both  
old and new



Cross Section Through Furnace

### THE BURKE FURNACE

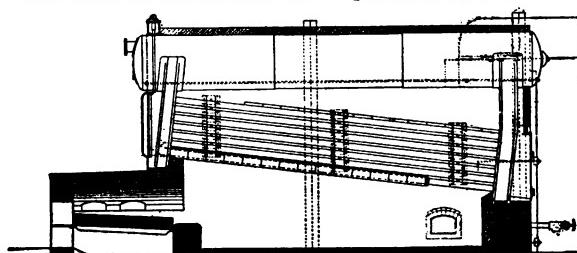
The Burke Furnace is of the gravity feed type and consists of a basket grate covered by a fire brick arch. Coal is fed to the feed pockets at the sides of the arch, cokes on the slanting side grates and when more fuel is needed moves toward the center grates, the fresh fuel taking its place on the coking grates.

The coking process being continuous, the volatile gases (the smoke makers) are distilled gradually and therefore in such small quantity at a time that it is possible to supply the amount of air needed for combustion. The necessary high temperature is maintained by means of the fire brick arch. As the coked coal is moved toward the center of the furnace the green coal falls down below and behind it, so that the gases liberated from the fresh coal must practically pass through a bed of incandescent fuel, wherein they are heated, mixed with the air coming up through the grates, and burned without smoke and with very high efficiency.

Actual trials have shown a saving as high as 35% over ordinary settings.

The great losses due to inrush of cold air when doors are opened for firing are avoided in the Burke Furnace, as no fuel is fed through the front doors. These are for cleaning purposes only. As it is thus possible to maintain a practically constant temperature in the boiler setting, the enormous wear and tear on boiler and brickwork, due to expansion and contraction with changing temperatures, is successfully eliminated.

The cost of installation and operation is much lower than that of any mechanical stoker, yet the results obtained will stand comparison with the best on the market.



Water Tube Boiler with Burke Furnace  
A Typical Burke Furnace Installation

The Burke Furnace is no experiment; hundreds are in daily use throughout the United States and Canada. Send for catalogue.

## MURPHY IRON WORKS

DETROIT, MICHIGAN

FOUNDED 1878

MANUFACTURERS OF THE MURPHY AUTOMATIC SMOKELESS FURNACE

THE MURPHY AUTOMATIC FURNACE is automatic in all its functions. It feeds and distributes the coal and removes the ash and refuse.

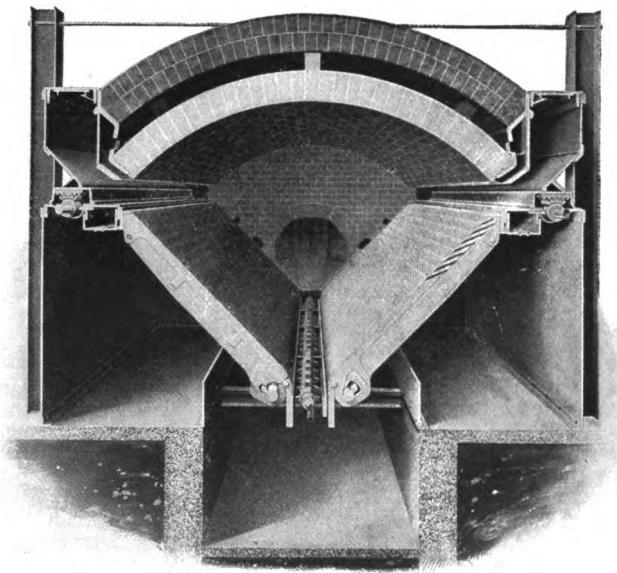
It is adaptable to any type of boiler and to units of any size.

It will handle economically all grades of bituminous fuels and is practically smokeless under normal operating conditions.

It is capable of handling variable loads and heavy overloads efficiently and with minimum attention.

The cost of maintenance is low, averaging about 10c. per horsepower per year.

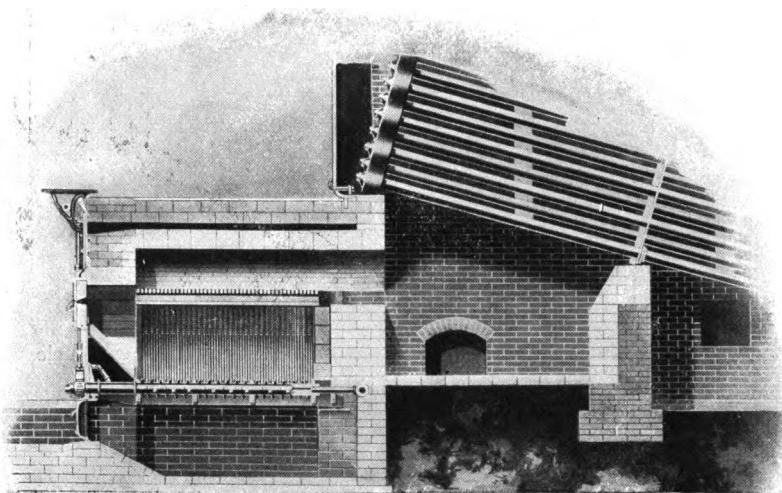
It operates with natural draft, the cost of actuation approximates  $\frac{1}{2}$  of 1 per cent of total steam generated.



The Murphy Automatic Smokeless Furnace  
REAR VIEW

Its usefulness is not limited to steam making, it will give excellent results in all operations where high temperatures are required, such as brick drying, cement burning, salt evaporation, calcining of soda ash, heating furnaces, etc.

## MURPHY IRON WORKS



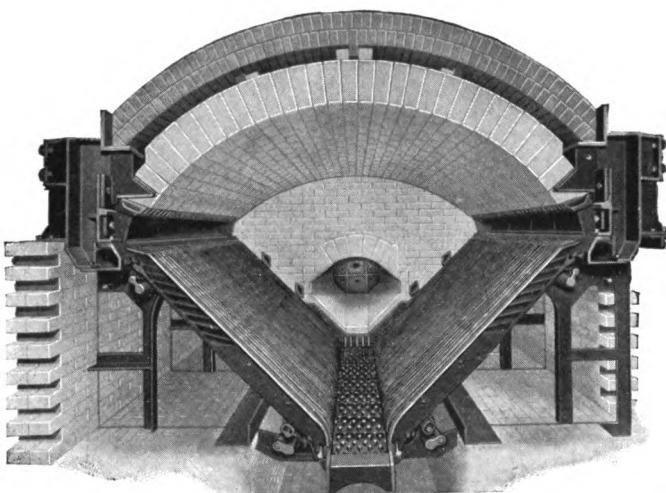
**Murphy Furnace—Dutch Oven Setting**

At either side of the furnace extending from front to rear is the coal magazine into which the coal may be introduced either by hand or mechanically. At the bottom of this magazine is the coking plate against which the inclined grates rest at their upper ends. The stoker boxes, operated by segment gear shafts and racks, push the coal over the coking plate and onto the grates. The grates are made in pairs, one fixed and the other movable. The stationary grates, at their lower ends, rest on the grate bearer, which also acts as a support for the clinker grinder. The clinker grinder consists of a square steel shaft, onto which is slipped small cast iron toothed segments, which are readily replaced in case of breakage. Just over the coking plate is the arch plate, from which a fire brick arch is sprung over the entire furnace. Upon this arch plate are cast numerous ribs to form a series of air ducts immediately over the coking plate, conveying the heated air from the chamber above the arch into the combustion chamber. This arch plate also forms the wall of the magazine. The furnace, or battery of furnaces, can be operated by a small automatic engine, motor or by overhead shaft and ratchet drive, as may be desired. Arrangement is made for exhaust steam connections at the lower end of the grates for the protection of this portion of the grates and clinker grinders and for the softening of the clinker. In connection with horizontal tubular boilers or water tube boilers horizontally baffled, the Murphy furnace can be installed with a flush front setting. Arrangement can be made for extended or Dutch oven settings, should this be desired.

**DETROIT STOKER COMPANY**  
**DETROIT, MICH.**  
**THE DETROIT STOKER**



Front view of two stokers in one battery to be operated by either a fully enclosed, adjustable speed, double engine or electric motor, as preferred. Either stoker may be operated by hand when desired. The openings through the front admit air for combustion. The even distribution of fuel on the grates insures high overload and good efficiency.



Rear view showing the double arch construction used when the stokers are installed with the extension setting. Air admitted through the front, under control, is heated between the arches and enters through openings directly over the coking coal as it is fed from the coal magazines at the upper end of the grates on both sides.

Each alternate grate is operated by links connected to the operating bar in front and have a slicing motion to keep the entire bed of fire moving towards the center of the furnace. The movement of the vibrating grates prevents the clinkers from forming on the grates.

The clinker crushers at the bottom, having a continuous motion, grind the clinkers and deposit the refuse in the ashpit below.

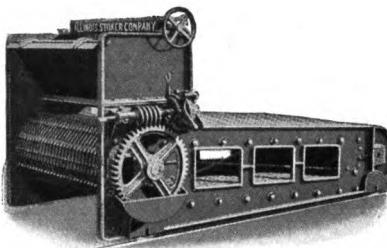
# ILLINOIS STOKER COMPANY

ALTON, ILLINOIS, U. S. A.

MANUFACTURERS OF CHAIN GRATE STOKERS

## THE ILLINOIS STOKER COMPANY'S GRATE STOKER

The general view of this Stoker is given in the illustration herewith. The coal is supplied to the traveling grate from the hopper, shown in the upper front part of the furnace. The grate in carrying the coal into the furnace passes under an adjustable gate which can be raised to give any desired thickness of fuel bed up to twelve inches by turning the hand wheel at the top of the Stoker. The adjustment, together with the variable speed at which it is possible to operate the grate by means of the speed adjusting lever shown on the driving mechanism, makes it possible to feed any desired number of pounds of coal per square feet of grate surface per hour into the furnace.



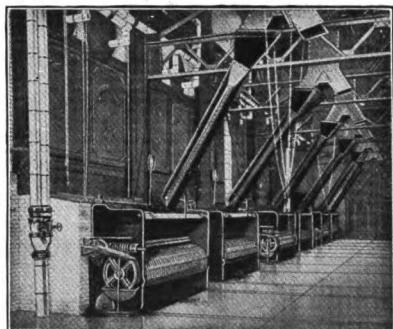
Showing driving mechanism of Stoker  
of the speed adjusting lever shown on the driving mechanism, makes it possible to feed any desired number of pounds of coal per square feet of grate surface per hour into the furnace.

By controlling the thickness of the fuel bed and speed with which the coal is fed into the furnace, it is possible to obtain any desired load from the boiler with coal of either very high or very low heat value, or coal very small or coarse in size.

By raising or lowering the gate and determining the thickness of the fuel bed, which is fed into the furnace, proper allowance can be made for the burning of coal of various sizes. For example: Assuming that the draft over the fire is constant, the larger size of coal will have larger air spaces between the individual pieces of coal than a coal of smaller size, so that with a given draft more air will be forced through a coal bed six inches thick while burning the larger size of coal than will be forced through the same thickness while using coal of a smaller size. Adjustment should therefore be made in each case so as to obtain the proper amount of air through the coal for the proper burning of the particular kind of coal used.

The ease with which the gate can be lowered or raised in the Illinois Stoker makes it feasible to maintain the proper thickness of the fuel bed for each kind of coal supplied to the furnace. The exact thickness of the fuel bed is at all times indicated in inches by the gauge shown just above the handle for raising the gate.

Attention is called to the solid construction of the side frame of this Stoker, which is cast in one single piece from the front to the rear of the Stoker, so that the entire chain and driving mechanism is supported on this single solid casting. This construction is found only in the Illinois Stoker and makes it the most rigid and substantial Stoker on the market. Note the heavy ribs on all edges of the side frame.



Illinois Stokers in operation

## GOOD FEATURES OF ILLINOIS STOKER

Heavy Castings throughout and Rigid Bracing. Sprockets engage on Rollers, not on rods. Evenness of chain due to close spacing of rollers. Uniform distribution of air supply through coal. Patented air baffling system in rear of grate. Large combustion space due to inclined grate. Excellent speed controls. Short Link. Minimum loss of coal through grate. Independent flat ignition arch. General appearance and mechanical design. Drums are used on the rear end instead of sprockets, hence there are no rear sprockets to cause trouble.

Complete illustrated catalogue mailed on request.

# GREEN ENGINEERING CO.

CHICAGO

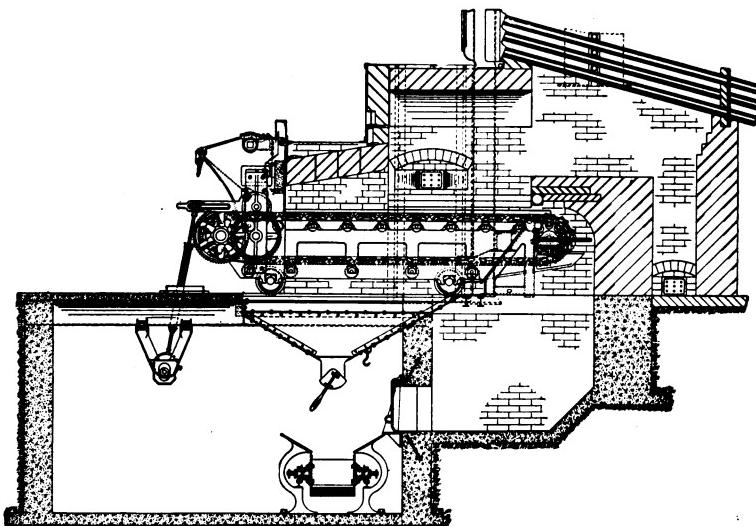
ILLINOIS

MANUFACTURERS OF GREEN CHAIN GRATE STOKERS; GECO RATCHET ASH DRAGS; GECO PRESSURE WATERBACKS; GECO PNEUMATIC ASH HANDLING SYSTEMS.

## GREEN CHAIN GRATE STOKER

THE GREEN CHAIN GRATE STOKER gives in service a practical demonstration of progressive combustion, the fuel being fed in at the front of the furnace and carried at regulated speed to the rear of the furnace, where, as ashes, it drops into the ash pit to be removed mechanically or by hand. Operation is entirely automatic and continuous. The fuel is ignited and coked at the front end of furnace, air is admitted through automatically cleaned air spaces in grate, and smokeless combustion with low grade fuel is produced. It will quickly pick up or drop a heavy load or economically bank the fire. Labor cost for cleaning furnace is low and the cost for repairs minimized.

Green Stoker Applied to a Horizontal Water Tube Boiler

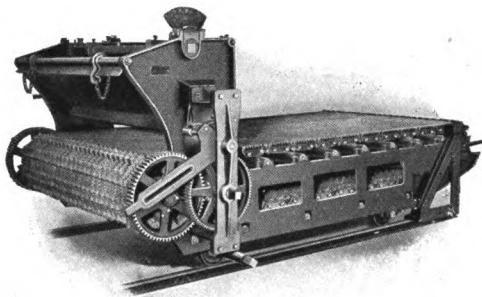


Construction

Two types of grates are made adaptable to any make of boiler. The fire bed may be level or sloping. The side girders of frame are entirely away from the fire and arranged to provide an increased air supply. Heavy cast-iron links, thoroughly ventilated, form the firing bed. These links interlock and automatically clear the air spaces without excessive loss of fine coal. The rear cross girder is fitted with a heavy plate on under side upon which ashes accumulate and, in connection with the members just above and below, prevent the passage of air around rear portion of grate, where ashes discharge; and this is further supplemented by dampers, which prevent the leakage of air past the side frames or below the lower part of the chain.

#### **GREEN CHAIN GRATE STOKER**

The grates are built in any width and in lengths from 9 ft. up to 12 ft. deep. Driving mechanism consists of ratchet, cast-steel pawls and cast-steel spur gear train babbitted in a special self-contained frame independent of, but bolted to the stoker front side frame. Quick adjustment may be had over a wide range and the source of power may be either above or below the boiler-room floor. A regulating feed-gate permits hard firing and is provided with an easily renewable tile lining, which prevents injury to the gate by fire eating back into coal hopper. The igniting arch is adaptable to any width furnace and easily renewable at low cost. It is flat, ventilated, and it gives uniform ignition the full width of the furnace and allows local repairs at any point without undue loss of use of the boiler.

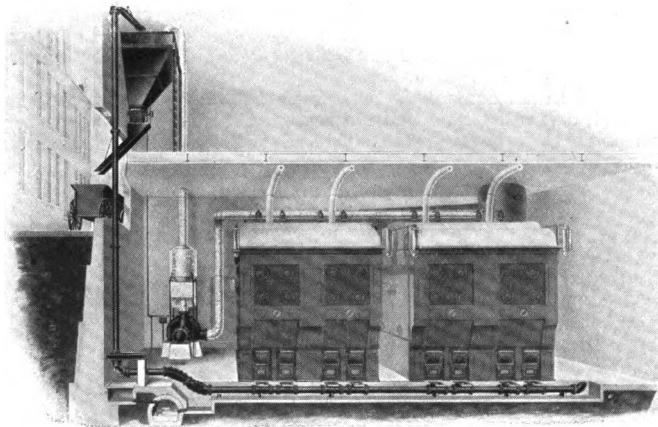


**Stoker Withdrawn From Setting**

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#### **GECO PNEUMATIC ASH HANDLING SYSTEM**

This system consists of a conveyor pipe located convenient to ash pits and provided with openings into which ashes are readily hoed. An air current of high velocity instantly carries the ashes to a separator and storage tank. On entering tank the ashes are automatically sprayed, thoroughly quenched, separated from air and deposited. An exhaustor produces the air current. Tank may be readily emptied by gravity into carts, or cars. One man operates system.



# LACLEDE-CHRISTY CLAY PRODUCTS CO.

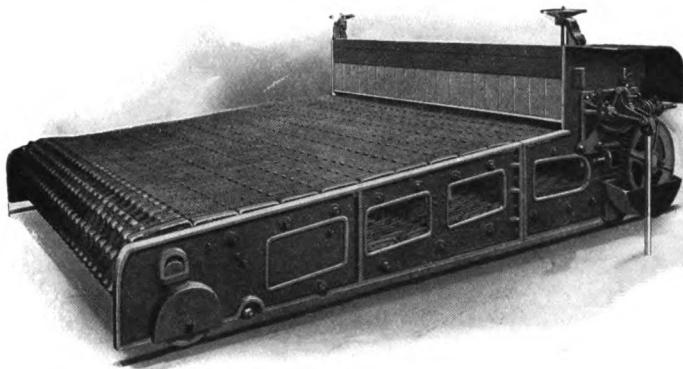
ST. LOUIS, MISSOURI

"LACLEDE-CHRISTY" CHAIN GRATE STOKERS; CLAY PRODUCTS  
AND REFRACTORIES; INDUSTRIAL PLANT CONSTRUCTION.

## CHAIN GRATE STOKER

The "Laclede-Christy" Chain Grate consists of an automatic, traveling, self-cleaning endless chain of narrow links all of the same design, supported on a strong rigid frame and operated by a simple driving device.

By means of a hopper and an adjustable feed gate, the coal is spread evenly across the width of the grate and carried under the patent ignition arch where the volatile gases are driven off and consumed. The remaining coke is consumed toward the back of the grate and the ashes discharged into the ash pit at the rear end of grate.



The frame work which supports the chain consists of heavy cast-iron sides tied together with rods and pipe spreaders and held rigid by a structural iron diagonal brace. Pipe rollers are provided to support the chain and the complete grate is mounted on four flanged wheels to fit tee rails. By this construction the stoker can be removed quickly from under the boiler for repairing the furnace.

Driving mechanism consists of a worm gear operated by a pawl and a ratchet wheel, driven by an eccentric fastened to a shaft either overhead or underneath. Speed may be closely regulated and in case of accident to the engine or motor the grate may be operated by hand.

## SPECIAL FEATURES

Evaporation is produced at a minimum cost for fuel and labor.

Boiler can be forced without losing economy.

It will burn any kind of bituminous coal without smoke.

It is self-feeding, self-cleaning and labor saving.

During operation it may be quickly adjusted.

Sprockets engage rollers instead of links.

It does not injure boilers or accessories.

Any fireman can make repairs should they become necessary.

Design permits of large combustion chamber.

Incline of grate permits of installation where headroom is limited.

# THE MODEL STOKER COMPANY

DAYTON, OHIO

## THE MODEL AUTOMATIC SMOKELESS FURNACE

We manufacture exclusively the Model Automatic Smokeless Furnace. An automatic furnace for power boilers which both stokes and cleans the fire, insuring practically complete or smokeless combustion, decided economy, superior utility, durability and low cost of maintenance.

It is an advance development of the double or side feed type.

All parts are well protected against destructive heat and readily adjustable to suit requirements. Stoker engine uses only about  $\frac{1}{2}$  of 1% of steam made.

Any or all parts can be operated by hand. Combustion is complete in fire chamber, and there is no smoke even when heat gases pass directly from under the arch to the water surface of boiler.

The improved construction renders it the most durable and most efficient furnace in use. Requires less fuel, less labor and less cost for maintenance for any given duty. Uses successfully any soft coal of feedable size. Responds readily to any variations and will crowd a boiler quickly and strong. Adaptable to any style of boiler and to every class of duty requiring high temperatures.

Coal can be supplied by gravity or by hand and ash removed mechanically or by hand.

### Improved Construction and Operation

The improvements embodied in the Model Automatic pertain to simpler and better construction, interchangeability of parts, greater durability, ready access and minimum cost for renewals, adjustability to meet varying requirements due to variations in fuel or of duty, regularity of fire, variable to suit requirements, constant automatic cleaning of fire, insuring continuous smokeless combustion, greater utility and minimum labor for attendant.

Its efficiency and general utility is admittedly unequaled by any other type or make of boiler furnace.

The only furnace which KEEPS the fire CLEANED.

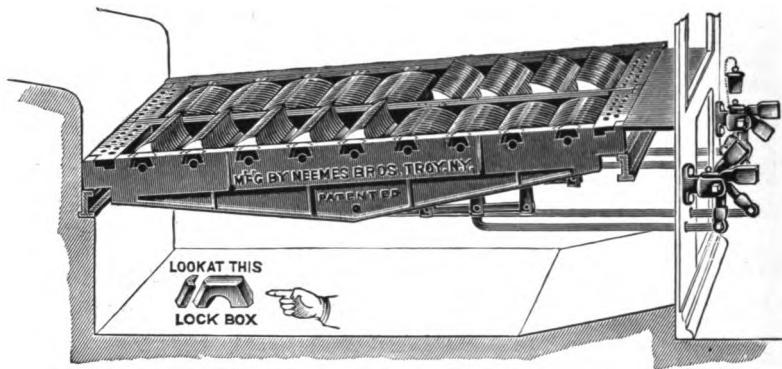
## *Shaking and Dumping Grates*

# NEEMES BROTHERS

24-30 RIVER STREET, ESTABLISHED 1874 TROY, N. Y., U. S. A.

Babcock & Wilcox, Ltd., Montreal, Canada. Sole makers for Canada.  
The Burke Engineering Co., 525 Industrial Trust Bldg., Providence, R. I.  
Sole Agents for the New England States.

### MANUFACTURERS OF SQUARE AND ROUND GRATES



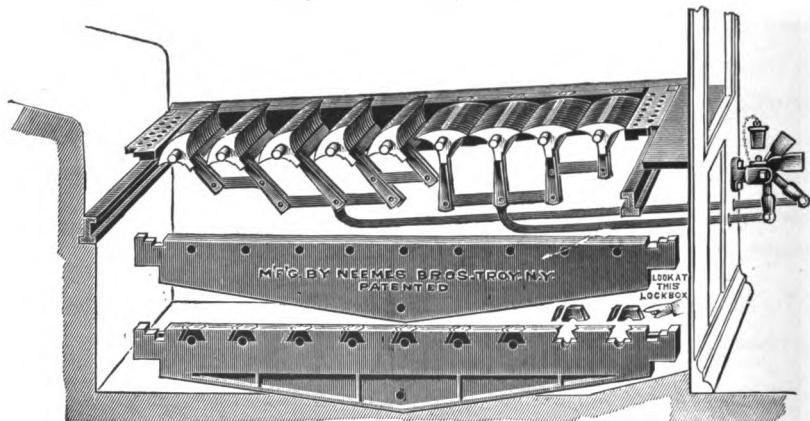
A COAL-SAVING GRATE

A grate which uses the coal wastelessly and which is so constructed that long life and continually satisfactory grate service are features.

### NEEMES BROS. IMPROVED SHAKING AND DUMPING GRATE

It is a triple value grate—enables you to shake out your ashes, cut out your clinkers, or dump your fire, if necessary. This grate cuts the clinker from both sides of the shaker alike. This is the kind of grate that is wanted today, and not one that merely shakes out a little ashes. It burns all kinds and grades of fuel, and burns it all up. The construction of the grate is strong. The teeth cannot break off, as we cut and crush the clinker in the center of the concaved teeth, and not on the points of the teeth. It is easy to operate, thoroughly dependable; it accomplishes perfect results with cheaper coal and with less coal than you are now using, thus effecting a double saving, and assures perfect combustion of any grade you may use. The Lock Box is also an important feature. When the shakers are set in the frame, and the boxes put in with the locks, no shaker can possibly raise in the fire.

This grate is backed by many years' experience as grate manufacturers.



# ST. JOHN GRATE BAR CO.

A. B. WILLOUGHBY, Manager

MACHINERY DEPT.

THE BOURSE,

PHILA. PA.

CONSULTING AND MECHANICAL ENGINEERS, EXPERTS IN COMBUSTION.

MANUFACTURERS OF WILLOUGHBY'S PATENT IMPROVED SHAKING GRATES AND FURNACES, WILLOUGHBY'S PATENT ALTERNATING SHAKING GRATES FOR FIRE ENGINES AND ALL BOILERS WITH CIRCULAR FIRE BOXES.

## WILLOUGHBY'S ST. JOHN PATENT IMPROVED SHAKING GRATES AND FURNACES

These grates are especially suitable for internally fired Corrugated Furnaces, but are used to advantage in all kinds of boilers and furnaces, with any fuel, and with natural, forced or induced draft.

### FIRES CLEANED BY SHAKING

Their use does away very largely with the need of "cleaning fires," since the construction and operation is such that all refuse can be broken up and passed through the bars by shaking. These grates have been run seven weeks without cleaning, using Pittsburgh coal in internally fired boilers.

### INCREASED BOILER CAPACITY

The air space of these grates is so much greater than that of other types that much more coal can be burned per foot of grate surface, thereby evaporating more water and increasing the capacity of the boiler. It is also possible to burn inferior coal with good results, and less clinker than with other grates.

### CONSTRUCTIONAL FEATURES

These grates run longitudinally, and present a flat surface to fire upon, over which a slice bar or hoe may be used without catching. This is a very advantageous feature not found in other shaking grates.

### SUMMARY OF ADVANTAGES

The most business-like grate on the market, absolutely "*fool proof*."  
It is simple in construction. Easily operated.

It will reduce your coal bills. Adapted to any style furnace.

No cold air over the fire.

Adapted to either hard or soft coal.

Will reduce the clinker to a minimum.

Increased air space. Will improve the efficiency of your boiler.

Cleanings are reduced to a minimum, and doors kept closed longer than with any other method.

No bolts or nuts or cotter pins to become loose or broken and drop out, thus disabling grate at the most inopportune times.

### GUARANTEE

With the installation of the WILLOUGHBY PATENT IMPROVED SHAKING GRATES, we will guarantee the ability to develop twenty-five per cent higher capacity than can be secured from flat stationary grates under like conditions, or, we will guarantee the ability to develop the same capacity as you now secure (from flat grates) on at least ten per cent less fuel under like conditions on a twenty-four hour (or longer) run. Provided: an evaporation test be made with both flat grates and this grate in the presence of our representative.

CATALOG ON REQUEST

## *Radial Brick Chimneys*

# ALPHONS CUSTODIS CHIMNEY CONSTRUCTION CO.

BENNETT BUILDING, NEW YORK

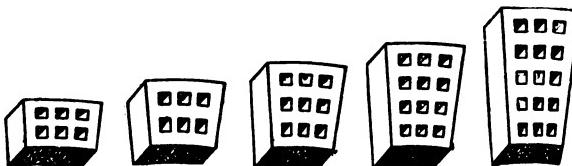
Chicago, Ill., First Nat'l Bank Bldg. Atlanta, Ga., Empire Bldg.  
Philadelphia, Pa., Penn Mutual Bldg. Detroit, Mich., Moffat Bldg.  
Kansas City, Mo., Reliance Bldg. Boston, Mass., Oliver Bldg.  
San Juan, Porto Rico, Belaval Bldg. Montreal, 304 University St.  
Toronto, Stair Bldg.  
Ottawa, 81 Bank St.  
Winnipeg, 445 Main St.

**DESIGNERS AND BUILDERS OF RADIAL BRICK CHIMNEYS**  
All Sizes      For All Purposes

We design chimneys of all sizes and for all purposes. The boilers, the coal used, temperatures, gases generated, geographical location and many other conditions affect the determination of the most economical and efficient size of a chimney.

The ALPHONS CUSTODIS CHIMNEY CONSTRUCTION COMPANY, through its forty years of experience, is equipped to give expert advice as to the size and shape of any kind of a chimney for any purpose, as well as make recommendations through their engineers regarding boiler lay-outs, size, shape and design of flues. If you will tell us your conditions and the results you wish to accomplish, we will promptly tell you the correct, efficient and economical size of chimney, and will make recommendations to you, not from theoretical tables, but from forty years' experience and unpublished data we have collected from actual working conditions of our chimneys all over the world.

The fact that over 6000 Custodis Radial Brick Chimneys are now in successful operation is conclusive proof of their efficiency, permanency and economy.



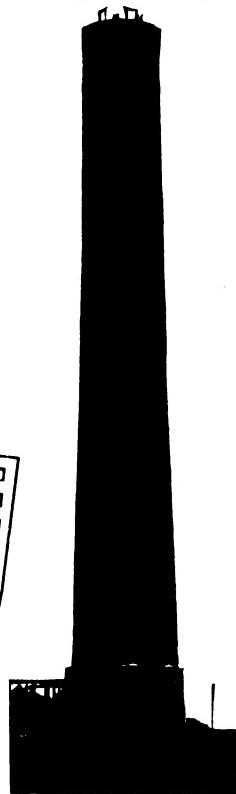
*The Perforated Radial Blocks* are made only from the purest clays, selected for high refractory powers and high crushing strength. Special attention is given to our brickyards to make the proper mix of clays in the right proportion to produce a radial chimney which will resist heat strains as well as strains from weight and wind.

All the radial blocks are formed to suit the circular and radial lines of each part of the chimney, so that they can be laid with thin even joints and produce a regular smooth surface.

The blocks are larger than common bricks, making the number of mortar joints in a RADIAL BRICK CHIMNEY one-third of those in a common brick chimney of the same size.

Moulded with vertical perforations, as shown in the cuts above, the RADIAL BLOCKS are most thoroughly and uniformly burned, increasing, to a marked degree, their density and strength. The perforations form a dead air space around the chimney, insulating the hot column of rising gases on the inside from sudden changes of temperature of the outer air, resulting in a maximum draft under all conditions.

**The Tallest and Largest  
Chimney in the World.  
Weight 17,000 tons.**



View of completed chimney.  
Boston & Montana C. C. &  
S. M. Co., Great Falls, Mont.  
506' x 50' 6". Built in 1908.

## *Coal and Ashes Handling Machinery*

### C. W. HUNT COMPANY

WEST NEW BRIGHTON, STATEN ISLAND, NEW YORK

New York City Office: 45 Broadway

**COAL AND ASHES HANDLING MACHINERY  
FOR POWER STATIONS, BOILER-ROOMS, COALING STATIONS, ETC.**



Single Door Charging Car

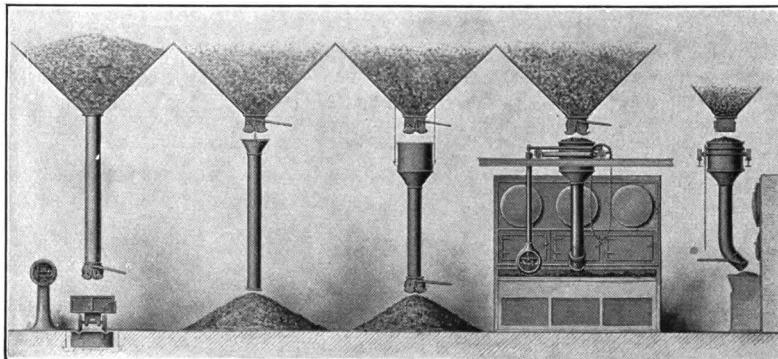


Tip Car for Handling Ashes

#### **"INDUSTRIAL" RAILWAYS AND CARS**

These cars are designed for bringing coal from the storage bins to boiler-rooms and retort houses. This is not only the most convenient and economical way of carrying coal to the boiler-room, but it is the least laborious in firing, as the coal is at the most convenient distance from the furnace and at the right level for ease in shoveling. The coal remains in the car until it is shoveled directly into the furnace, and the floor of the boiler-room is kept entirely free from dust and dirt, and as clean as the most fastidious could desire.

We build a great variety of narrow-gauge cars for handling materials. Full particulars will be found in our catalogue, "Industrial" Railways.



#### **SPECIAL SCALES FOR BOILER-ROOM SERVICE**

These scales are for use in boiler-rooms and manufacturing establishments where coal or other material is kept in overhead bins, from whence it can be drawn into the weighing hopper and its weight taken. The contents can then be spouted from the lower end of the hopper into the steam boiler stokers. The entire outfit—scales, hopper and spout—is suspended from a trolley that runs along an overhead track; hence the scale and apparatus can be moved from boiler to boiler; or if separate scales are installed at each boiler, they can be moved out of the way when it becomes necessary to inspect or repair the boilers. The weighing beam is brought down to a convenient height from the floor.

#### **THE HUNT NOISELESS GRAVITY CONVEYOR For Handling Coal and Ashes in Power Plants**

The Hunt Conveyor is especially suitable for difficult installations, the construction of the chain being such that the Conveyor can make quarter turns, and can run vertical, horizontal, or inclined, the buckets hanging upright in all positions of the chain. The Conveyor is noiseless in operation, every bearing is kept thoroughly lubricated, and the entire equipment is as durable as the best machine tools.

#### **OTHER HUNT PRODUCTS**

Cable and Automatic Railways, Electric Locomotives, Hoisting and Conveying Machinery, Steeple Towers, "Stevedore" Transmission and Hoisting Rope, etc.

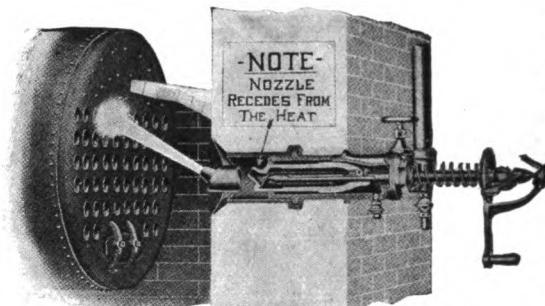
## DIAMOND POWER SPECIALTY CO.

1534 Monroe Building  
CHICAGO

Main Office and Factory  
70 First St., DETROIT

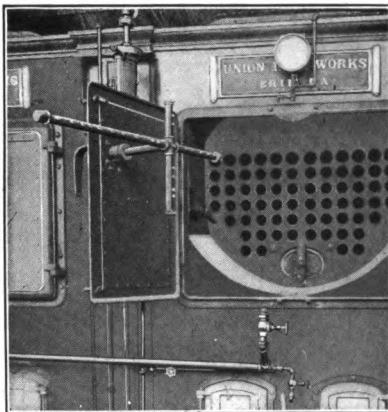
702 Singer Building  
NEW YORK CITY

### SOOT BLOWERS FOR ALL STANDARD BOILERS



1. Rear-End Design—For Return Tubular Boilers

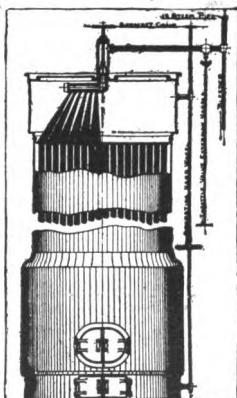
—have been developed through 15 years of experience in this field. These Diamond Soot Blowing Systems are permanently attached to the boiler—enabling the engineer to keep his heating surfaces free from soot at all times, by a simple mechanical steam-scouring action.



2. Front-End Design—For Fire Tube Boilers

### OVERCOMING SOOT

The wasteful action of soot deposits—both in lost heat and in boiler depreciation—make necessary a positive method of overcoming this. In meeting this need these Soot Blowers produce an important economy in the plant.



3. For "Manning" Boilers

### CLEANING FIRE TUBE BOILERS

Horizontal Return Tubular Boilers are cleaned from either rear or front end. The "Diamond" "Single Telescopic Jet" (see Fig. 1), "Swinging Arm," and "Revolving 5-Hole" Designs—are Rear End Designs. Fig. 2 shows the "Front End" Blower—open for inspection.

Vertical Fire Tube Boilers—"Manning" Type—are cleaned from top as shown in Fig. 3. Either "Swinging Arm" or "Revolving 5-Hole" designs are applied here.

# DIAMOND POWER SPECIALTY CO.

Bourse Bldg.  
PHILADELPHIA

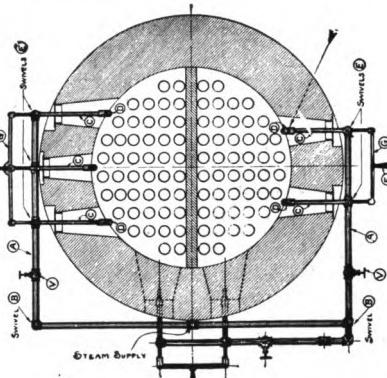
422 Fulton Bldg.  
PITTSBURGH

Suite 24, 19 Pearl St.  
BOSTON

## SOOT BLOWERS FOR ALL STANDARD BOILERS

### CLEANING WATER TUBE BOILERS

Soot is cleaned from the almost inaccessible points in many designs of water tube boilers—by special "Diamond" Blowers. These are now being used in a wide range of plants on such types of boilers as the following: "Hollow Stay Bolt," "Wickes" (see Fig. 4), "Stirling" (see Fig. 5), and Babcock and Wilcox.

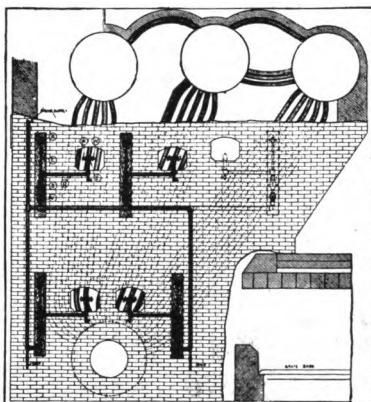


4. Cross-section showing application to  
"Wickes" Boilers

### OUR ENGINEERING SERVICE

From complete files of plans and specifications covering hundreds of makes of boilers, our Engineering Department is able to co-operate with you promptly in considering the proper Soot-Blowing System for any particular installation. You should take advantage of this.

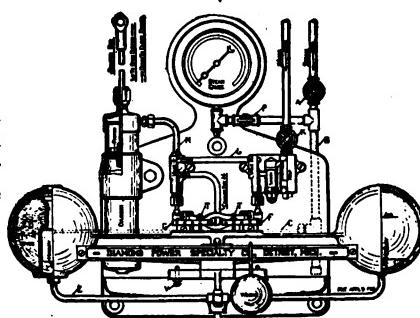
*Send for detailed literature.*



5. As applied to "Stirling" Boilers

### DRAFT REGULATION

The regulation of the air supply in a furnace is automatically taken care of by the "Diamond" Damper Regulator which opens and closes the drafts as required. (See Fig. 6.)



6. "Diamond" Damper Regulator

# AMERICAN BLOWER COMPANY

DETROIT, MICH.

MANUFACTURERS OF HEATING, VENTILATING, DRYING, MECHANICAL DRAFT AND BLAST EQUIPMENT; VERTICAL SELF-OILING STEAM ENGINES; STEAM TRAPS; FANS AND BLOWERS FOR ALL PURPOSES.

## "SIROCCO" FANS and BLOWERS (The Original Turbine Type)

### DISTINGUISHING FEATURES

"Sirocco" Fans have a large intake chamber practically unobstructed by the projection into it of blades or other parts, and employ blades which are short radially and very long axially.

### COMPARATIVE CAPACITY

Some idea of the great capacity of the "Sirocco" Wheels may be gained by a comparison of two wheels of equal diameter and speeds. The "Sirocco" will discharge  $3\frac{1}{4}$  times more air and produce  $5\frac{1}{4}$  times more pressure than an ordinary steel plate fan will; or delivering equal volumes against equal resistances, the "Sirocco" Fan Wheel will be 16% smaller, run at 72% of the speed and require 20% less power; or for the same horse-power input to each fan, the "Sirocco" will deliver 25% more air at 70% of the speed; or with housings of the same height the "Sirocco" Fan has 35% greater capacity at 65% of the speed.

### GENERAL

In the "Sirocco" Fan are combined conservation of space, speed and power in a way never before equalled in a fan of any other type.

Built in any size needed to meet given conditions.

Complete description, capacity tables, etc., in Bulletin No. 284.

### VERTICAL SELF-OILING STEAM ENGINES

Type A—Single Cylinder  
“E—Double “

### DISTINGUISHING FEATURES

These engines will run from three months to two years without requiring adjustment or the addition of oil to the original supply. These long runs without attention are made possible by the patented oiling system. Every frictional surface is running on oil; there is no contact between metals, which eliminates wear.

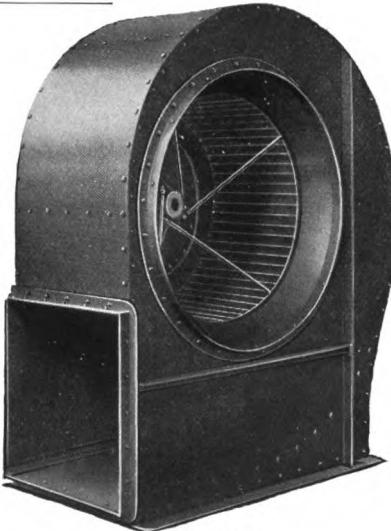
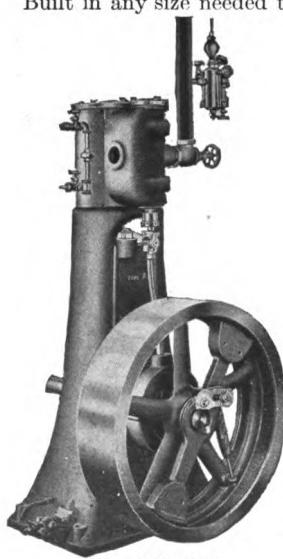
### ADAPTABILITY

Unexcelled as a motive power for any duty within their capacity. These engines have no equal for driving electric generators, excitors, centrifugal and all types of power pumps, paper machines, centrifugal dryers, etc.

### CAPACITY

Up to and including 120 horse-power.

Complete descriptive matter, specifications, etc., in Bulletin No. 334.



"Sirocco Fan"

# AMERICAN BLOWER COMPANY

## "DETROIT" STEAM TRAPS

The only successful modifications in tilting traps made in years have been embodied in the "Detroit."

The "Detroit" Traps are the simplest possible mechanism for automatically holding steam in check and delivering water. They are applicable anywhere that steam is used, for whatever purpose, and can be used for draining any system on which a pot, float or bucket trap is now or would be used.

All working parts are on the outside, in plain sight, and easily accessible. The tilting of the tank indicates at all times the successful operation of the trap. There is no ball or float inside the receiver and nothing to leak, collapse, rust, corrode, or stick. The valve seats and discs are renewable.

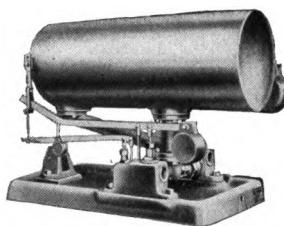
*The Return Trap* takes condensation from whatever source and delivers it to the boiler at practically the temperature at which it is condensed.

*The Non-Return or Separating Traps* are perfectly adapted to draining oil and steam separators; bleeding high or low pressure headers; draining receivers between high and low-pressure cylinders in compound engine installations, etc.; in fact, any service within their capacity in rubber plants, paper mills, power plants, heating, drying and cooking apparatus, vacuum pans and triple effects in salt works, sugar refineries, etc.

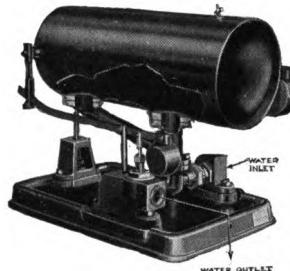
Condensation can be most successfully removed from any apparatus or system working under a vacuum by "Detroit" Vacuum Traps.

Live steam or compressed air is employed for discharging the trap or elevating the contents to any desired height within the limit of the pressure admitted to the steam valve.

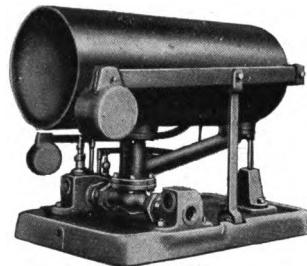
In construction the "Detroit" Vacuum Trap is a modification of the "Detroit" Return Trap.



"Detroit" Automatic Return  
Steam Trap



"Detroit" Separating Trap



"Detroit" Vacuum Trap

## "DETROIT" RETURN OR VACUUM TRAPS CAPACITY

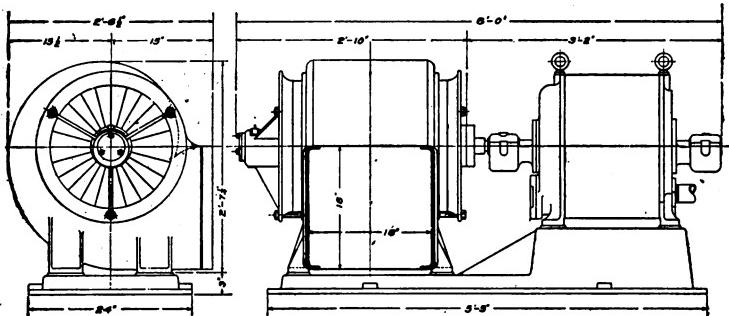
Size Trap	Water Inlet and Outlet	Size Steam Inlet	Pounds Per Hour	Square Feet Direct Radiation	Lineal Feet 1-Inch Pipe Direct Radiation	Approximate Shipping Weight lb.	Telegraphic Code Word Return Trap
10	$\frac{3}{4}$ "	$\frac{1}{2}$ "	830	2800	8400	275	Dabbler
11	1	$\frac{3}{4}$ "	1500	5000	15000	325	Dabble
12	$1\frac{1}{4}$	1	2500	8300	25000	425	Dabster
13	$1\frac{1}{2}$	$1\frac{1}{4}$	5000	16500	50000	500	Dacapo
14	2	$1\frac{1}{2}$	6600	22000	66000	700	Dactyl
15	$2\frac{1}{2}$	2	15000	50000	150000	900	Daddock
16	3	2	24000	80000	240000	1000	Dagger

Capacities are based on average direct radiating conditions.  
For capacities Separating Traps, ask for Curve Sheets Nos. 237-A and 238-A.  
Complete description in Catalogue No. 326.

# McEWEN BROS.

WELLSVILLE, N. Y.

CENTRIFUGAL PUMPS, BLOWERS, BOILERS, FLEXIBLE COUPLINGS



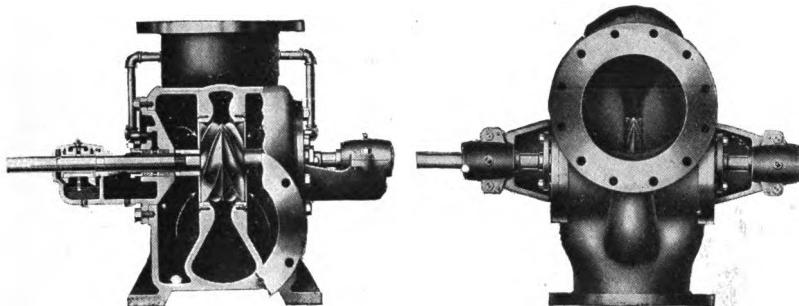
## BLOWERS FOR FORCED DRAFT

To develop the maximum capacity of a boiler plant mechanical draft is necessary. Chimneys cannot produce draft enough; and where the underfeed or retort types of stokers are used, forced draft is indispensable. Steam turbine driven forced draft blower units are ideal. The turbine runs perfectly on the throttle or under pressure and air control. The exhaust from the turbine is clean and may be used for feed water heating without danger to boilers or the cost of using and removing cylinder oil. But for highest economy the blower must run at turbine speeds. For instance, a small steam turbine develops 15 brake horsepower at 1000 r.p.m. and 40 brake horsepower at 3500 r.p.m., with the same pressure and total steam per hour. A larger turbine of another type develops 80 brake horsepower at 600 r.p.m. and 160 horsepower at 1600 r.p.m. with the same pressure and total steam per hour. The best blower for forced draft service is the one which runs as well as the turbine and at its best speed.

Size	Outlet	Weight	Space Required,			Total Air Pressure, 1-4" w.g.		Total Air Pressure, 4-8" w.g.	
			Length	Width	Height	Capacity, c.f.m.	Speed, r.p.m.	Capacity, c.f.m.	Speed, r.p.m.
18"	18x18	400	34	29	31	6200-12400	1870-3740	9400-13350	2830-4000
24"	24x24	700	40	39	42	11000-22000	1400-2800	16700-23500	2120-3000
30"	30x30	1150	46	49	52	17300-34600	1120-2240	26200-37200	1700-2400
36"	36x36	1700	54	60	63	25000-50000	940-1880	37700-53500	1410-2000
42"	42x42	2300	60	70	73	34000-68000	800-1600	51300-72800	2120-1700
48"	48x48	3000	66	80	84	44000-88000	700-1400	66800-95000	1060-1500

**CASING.**—Cast-iron sides with sheet steel volute. **BEARINGS.**—Babbitt lined, ring oiling, dust proof, oil proof. **ROTOR.**—Increase pitch propellers with central deflector, on nickel steel shaft. Stays in balance. Removable endwise. **PAINTING.**—Filled and painted inside and out with oil and acid proof flat finish machine enamel. **RATING.**—Capacity stated for maximum efficiency at required pressure. Economic range from 25% below to 25% above rating with efficiency above 90% of maximum. **GUARANTEE.**—Best material and workmanship and rated capacity. Faulty parts failing within a year of shipment replaced by duplicates f.o.b. works on request.

## McEWEN BROS.



## HIGH SPEED CENTRIFUGAL PUMPS

The cuts above illustrate the type of high-speed centrifugal pump designed especially for steam turbine drive on condenser and hot well service in power plants and for other service where large volume at low head and high speed is desired with better unit economy or lower operating cost. High suction lift possible.

Size	G.p.m.	Head	R.p.m.	Pipe Vel.	Floor Space	Weight
8"	800-2000	5- 50'	1200-4000	7-13'	24"x 38"	900 lb.
10"	1800-3000	5- 50'	1000-3200	7-13'	28"x 42"	1200 lb.
12"	2500-4500	5- 50'	900-2700	7-13'	44"x 44"	1600 lb.
16"	3600-7500	10- 80'	1000-3000	7-13'	44"x 58"	2200 lb.
20"	6000-12000	10- 80'	900-2600	7-13'	53"x 67"	3300 lb.
24"	9000-18000	10-100'	700-2300	7-13'	63"x 78"	4500 lb.
30"	15000-30000	15-100'	700-1800	7-13'	75"x 85"	7000 lb.

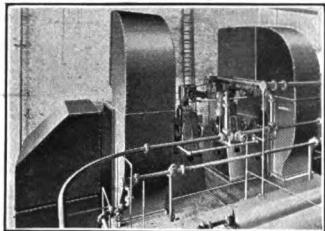
CASING.—Close grained, sound cast-iron, with volute suction and discharge. Removable bronze throat. BEARINGS.—Split shells lined with best babbitt, or made entirely of lead bronze if preferred. Laminated oil rings. Bearings removable without disturbing shaft. ROTOR.—Helical type bronze impeller on nickel steel shaft, bronze covered where exposed to water. Removable endwise from casing. STUFFING BOX.—Best hydraulic packing, water sealed. Bronze gland recessed to prevent slinging water. COUPLING.—Flexible type, all steel with reservoir lubrication. PAINTING.—Filled and painted with oil and acid proof, flat finish, steel color machine enamel. GUARANTEE.—Best efforts made to fit the pump to its work. Material and workmanship best for the purpose. Parts failing from defect within one year from shipment renewable by duplicate f.o.b. works. RATING.—Pumps rated at highest efficiency for required head and speed. Economical range, 25% below to 25% above rated capacity.

## B. F. STURTEVANT COMPANY HYDE PARK, MASS.

Offices in Larger Cities

MECHANICAL DRAFT, FUEL ECONOMIZERS, STEAM TURBINES, STEAM ENGINES, GASOLENE ENGINES, GASOLENE ENGINE GENERATING SETS, MOTORS, GENERATORS, STEAM TRAPS, HEATING AND VENTILATING SYSTEMS, FANS, BLOWERS, EXHAUSTERS, ETC.

### MECHANICAL DRAFT



Draft produced by a fan is called mechanical draft, and may be forced or induced as conditions demand. Its cost is from 20 to 40 per cent of that of a chimney. Its intensity permits of the burning of finely divided or low grade fuel. It makes possible the utilization of the flue gases which a chimney wastes in producing draft, it is independent of the weather, decreases smoke, increases the capacity of an existing plant, and serves as an auxiliary to a chimney already overburdened. It saves space and is portable.

### FUEL ECONOMIZERS

The Sturtevant Economizer effects:  
A saving of 10 to 20 per cent in fuel,  
An increase of 20 to 40 per cent in boiler capacity,  
An appreciable extension of the life of a boiler,  
A purification of the feed water,  
A reduction in expense of repairs,  
The deposit of large amounts of soot.

In the Sturtevant Economizer the pipes are arranged "staggered" instead of in straight rows, thereby giving the pipes a better opportunity to absorb heat from the gases. These economizers are made with taper metal-to-metal joints that require no packing, cement or rusting. The placing of the pipes of one row opposite the spaces of the adjacent sections increases the effective area of the transmitting surfaces and thoroughly breaks up the currents of hot gases by directing them between the pipes and against those standing in their paths.



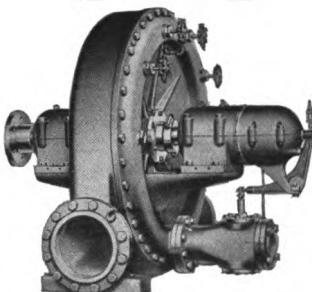
### STEAM TURBINES

The Sturtevant Steam Turbine is of the multi-velocity type, and its operation is such as to give high efficiency, and permit of moderate rotative speeds without gears. Hand valves are used for shutting off the nozzles, and the speed is regulated by a centrifugal throttling governor placed on the end of the shaft.

No special foundations are required and the turbine can be placed on an ordinary floor. Internal lubrication is unnecessary, therefore the exhaust steam is free from oil.

5 regular sizes from 5 to 250 H.P.

Approximate speed from 4000 to 1000 R.P.M.



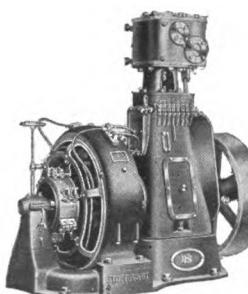
### STEAM ENGINES (Automatic High Speed)

Vertical Single Cylinder from 5 to 87 H.P.  
Vertical Compound from 35 to 171 H.P.

Horizontal Center Crank Engine from 39 to 225 H.P.  
Sturtevant Engines are adapted to continuous operation for long periods without attention. Gravity lubrication and complete enclosure of moving parts insure cleanliness and high mechanical efficiency. Rites Governor gives 1½ per cent speed variation only.

### MOTORS, GENERATORS AND GENERATOR SETS

Direct Current Apparatus for any Standard Voltage		
Bi-Pole Motors (enclosed and semi-enclosed type).....	1/4	to 3 H. P.
Four-Pole Motors.....	2	to 30 H. P.
Eight-Pole Motors.....	1	to 225 H. P.
Six-Pole Generators.....	5	to 17½ K. W.
Eight-Pole Generators.....	20	to 150 K. W.
Turbine Generating Sets.....	3	to 50 K. W.
Steam-Engine Generating Sets.....	5	to 150 K. W.



## B. F. STURTEVANT COMPANY

### STEAM TRAPS

This steam trap, made for different pressures, is designed for steam heaters or radiators of any construction. Both extension and cone are of brass ground to a fit. The pot is readily removed for cleaning by loosening up the bolts.

### PROPELLER FANS

Propeller fans are designed for use against low pressures, and are applicable for ventilation and exhauster work in boiler and engine rooms, kitchens, clubrooms, smoking rooms, offices, stores and similar places. They are constructed with a frame of cast iron, that is fastened into the wall of the building and are driven by either belt or direct-connected electric motors that are enclosed and dust-proof. The construction of these propeller fans is exceptionally strong and durable. Propeller fans are made in sizes of from 18 to 120 inches in diameter.



### MULTIVANE FANS

Multivane blowers and exhausters driven by direct-connected Sturtevant motors, turbines, and engines form the most satisfactory and efficient fan sets on the market. The blast wheel or runner for this fan is composed of shallow floats, which permit the use of very large inlets while maintaining the necessary blade area. The large inlet allows the air to enter with the least loss in friction.

Each blade or float is spooned to distribute equally the pressure within the casing and to add rigidity and strength to the wheel.



### STEEL PLATE FANS

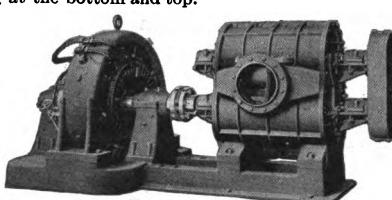
Sturtevant steel plate fans are designed for all sorts of blower and exhauster work. They are the result of fifty years' experience in blower design, are especially strong and durable and are suitable for direct-connected steam engine and electric motor drive and for belt drive. Steel plate fans are built for ventilation and mechanical draft installations, and for planing mill and other exhauster work.

### BLOWERS AND EXHAUSTERS

The Sturtevant High Pressure Blower is made in two types; in the smaller sizes the idler is directly above the impeller, and the shafts lie in a vertical plane. In the larger sizes, the shafts are in a horizontal plane, the intake and discharge being at the bottom and top.

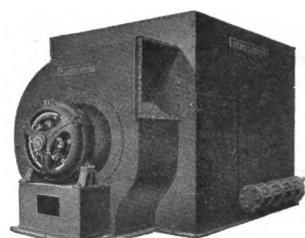
High Pressure Blowers are designed to deliver air at pressures up to five pounds. They are especially adapted to furnishing blast for cupolas, gas and oil burners, annealing and smelting furnaces, cement kilns, and for all sorts of blower or exhauster work demanding high pressures. Special stuffing-boxes to prevent leakage are furnished when these blowers are used to handle gases.

The B. F. Sturtevant Company makes complete installations, including direct-connected, belted, or geared engine or motor, exhauster, automatic regulator, blast gates, by-pass connections, and valves.



### STURTEVANT HEATERS

The Sturtevant fan system of heating and ventilating is economical and positive, heated air providing ventilation as well as heat. Indirect hot blast coils are built of one inch extra heavy steel pipe screwed into cast iron sectional heater bases. Entire heater is enclosed in steel plate casing. Heater is applicable to use of either live or exhaust steam or hot water. System can be used for heating and ventilating any sort of building. The operation is independent of the weather or of atmospheric conditions. The air may be washed, dried, moistened or cooled, as well as heated. Hot air from the heater is forced by a fan through ducts into the building to be heated, and is allowed to escape through vent flues. Fans are driven by steam engine, motor or belt. The steam engine exhaust is used in the heater, thus eliminating the expense of running the engine. Temperature of air entering each room may be closely regulated by thermostatic control.



## *Boiler Settings*

# H A R B I S O N - W A L K E R R E F R A C T O R I E S C O M P A N Y

PITTSBURG, PA.

SALES OFFICES : Pittsburgh, Chicago, Philadelphia, New York, Birmingham  
PLANTS in Pennsylvania, Indiana, Alabama, Ohio, Kentucky

FIRE CLAY, SILICA, MAGNESIA AND CHROME BRICK FOR THE POWER PLANT,  
THE IRON AND STEEL INDUSTRY, THE CEMENT PLANT, ETC.

Highest Quality Fire Brick, including Tongue and Groove Blocks and all special shapes for  
Boiler Settings, Locomotive Arches, Heating and Forge Furnaces, Cupolas, etc.

Magnesia and Chrome Brick for the Open Hearth, Electrical Furnaces, Dolomite Kilns, Bot-  
toms of Heating Furnaces, Copper Converters, etc.

### BOILER SETTINGS

We make a special feature of manufacturing brick for boiler settings.

The different types of boilers and the different fuels in use require varied properties in the brick used in different sections of the brickwork; in some cases the best brick to use depends entirely upon the heat-resisting properties; in others, upon resistance to the impinging action of flame and spawling; while in others, upon the ability to resist the action of clinker and poker, together with heat-resisting qualities.

The large units of the modern boiler, such as the Sterling, Babcock & Wilcox, Cahall, Heine, Wickes, Rust, Maxim and other types, require the best possible grade of brick in the setting, *especially in the arches*.

In boiler setting it is important that the workmanship and material be such as to minimize the possibility of a "shut down" due to failure of any part of the brickwork.

At our suggestion numerous changes have been made in boiler settings, particularly with regard to the kind of brick used at critical points; and these changes have been followed by marked improvement in the steam records of the boiler plants.

Whenever called upon to do so, we will have our engineering department get out blue-prints and counts, showing the number and most suitable brick required for different sections of the furnace walls for any type of boiler.

Our technical men, our laboratory and corps of chemists, our engineers, are at your service to solve any problems in the use of refractories.

### CAPACITY AND SHIPPING SERVICE

We operate numerous plants in the States of Pennsylvania, Indiana, Ohio, Kentucky and Alabama, from which we can promptly and economically supply our various brands of high-grade refractory materials.

The total daily capacity of our plants is 1,100,000 bricks.

# ALBERGER HEATER COMPANY

BUFFALO, N. Y.

FEED WATER HEATERS AND PURIFIERS

WATER HEATERS FOR GRAVITY AND FORCED CIRCULATION HEATING SYSTEMS  
HOT WATER SERVICE HEATERS FOR DOMESTIC USE

## THE ALBERGER MULTI-HEAD FEED WATER HEATERS

Experience has demonstrated that the most efficient way to heat water is to agitate it thoroughly, so as to bring all particles to be heated into direct contact with the heating surface. This is best accomplished in the Alberger Multi-Head Heater by breaking the water up into small columns, which in turn are broken up by the spiral corrugations in the tubes.

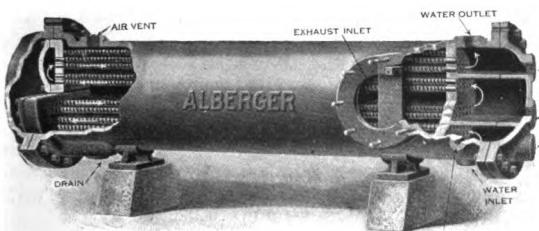
The Alberger Multi-Head Heater is made entirely of cast iron, except the heating surface, which is pure seamless drawn corrugated copper tubing tested to 1,000 lbs. pressure.

It is to be expected that those tubes on the cold or inlet water side of the heater, where water enters at a temperature of about 40°, will not expand nearly as much as those on the hot or outlet water side of the heater, where the temperature is 210° or practically that of the steam. It is easy to appreciate the unequal strains this difference in movement causes. In the Alberger Multi-Head Heater the design is such that the unequal expansion or contraction produced is taken care of in a very effective manner by a series of floating tube heads at one end of the heater, which permit the several groups of tubes to expand or contract entirely free from each other. This design obviates any possible trouble from the heater and assures for it a permanent life. These heaters can be furnished in either the vertical or horizontal type as may best suit existing conditions.

## ALBERGER MULTI-HEAD HOT WATER SERVICE HEATER FOR DOMESTIC SUPPLY

This type of heater is used very extensively in hotels, apartment houses, offices, hospitals, schools, club houses, restaurants, laundries, turkish baths, and swimming pools and various other similar institutions. In most installations of this nature more or less exhaust steam is available for heating purposes, in which case hot water may be had at a minimum cost. In plants where exhaust steam is not available, live steam frequently is used and the heater placed at such an elevation that the water of condensation will drain by gravity back to the boiler. Where a limited amount of exhaust steam is available, but not sufficient to heat the required amount of water, the deficiency may be made up by the use of a small quantity of live steam. This may be so regulated by means of a thermostatic controlling valve, that all of the exhaust steam is utilized before live steam is admitted to the heater. In this manner a thoroughly dependable piece of apparatus is secured. In practically all instances, the instantaneous heater without storage supply accomplishes to the best advantage the desired effect. However, in laundries and some other institutions where a large quantity of hot water is required in a short period, a storage tank is sometimes provided in connection with the instantaneous heater. This is especially the case where

the steam supply is limited, and the water is used at infrequent periods. It will be found that the Alberger Multi-Head Hot Water Service Heater for domestic purposes performs its functions in a very efficient manner. This heater is made in several forms to meet the particular conditions for which it is sold. The illustration below will give a comprehensive idea of the heater we recommend in order to obtain the best results.



**WM. BARAGWANATH & SON**  
**CHICAGO, ILLINOIS**

**FEED WATER HEATERS, PURIFIERS, CONDENSERS, COOLING TOWERS, SEPARATORS**

**FEED WATER HEATERS, STEAM JACKETED TYPE  
(Vertical and Horizontal)**

In the STANDARD TYPE as here illustrated the steam enters the bottom, passes up through the tubes, and returns down the annular space between the inner shell and the jacket. The water is fed through the side near the bottom and passes to the boiler through the side outlet at the top. The steam jacket prevents radiation of heat from the water, and a higher degree of heat can be obtained than with any other closed heater made. Properly proportioned drips, blow offs, and hand holes are provided.

THE INVERTED TYPE is the same in all respects as the STANDARD TYPE, except that the steam enters and leaves at the top.

THE HORIZONTAL TYPE is designed for use in low basements and for marine service. It has all of the advantages of the STANDARD TYPE and is widely used where structural conditions make the use of the vertical type impossible or unadvisable. All types built in sizes from 50 H. P. up.

**VERTICAL STEEL OPEN HEATER**

**(With Filter)**

This HEATER is especially suited for use in muddy water. Also in connection with heating systems, acting as a receiving tank.

The water inlet is sealed. The water flows over a series of cast iron trays, then passing through a down pipe into the settling chamber in the bottom of the heater, from which it filters upwards through the filtering chamber to the pump supply.

An outside connected float operates a balanced valve on the supply pipe.

The pans are readily removable through a large door, provided for that purpose. Built in sizes from 50 H.P. up.

**VERTICAL HOT WATER HEATER**

This HEATER is designed especially for heating water for domestic purposes and is particularly adapted to hotels, restaurants, laundries and other buildings requiring large quantities of hot water.

The natural circulation through the central tube is accelerated by the flow of incoming cold water, creating a strong circulation and making both upper and LOWER water chambers reservoirs of HOT water, thus providing against a sudden demand for the maximum requirements for hot water.

The manholes provided in both water chambers allow easy access for cleaning and inspection. Built only to order.

**BAROMETRIC CONDENSERS**

THE BARAGWANATH BAROMETRIC CONDENSER is simple, reliable and economical. It is always set at an elevation (usually 33 ft.) above the hot well, so that the height of the column of water in the tail pipe is sufficient to clear itself automatically of the water and air it contains.

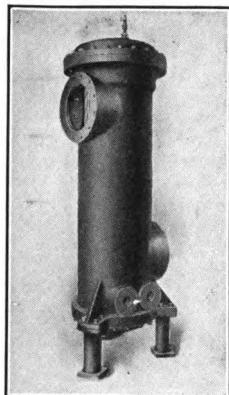
It is applicable to any purpose requiring a vacuum, and is used on engines, pumps, and vacuum pans with equal success. Except under special conditions of leaky connections, or very high vacuum requirements, no air pump is used.

CATALOG ON REQUEST.

## THE BLAKE & KNOWLES STEAM PUMP WORKS

MAIN OFFICE: 115 BROADWAY, NEW YORK

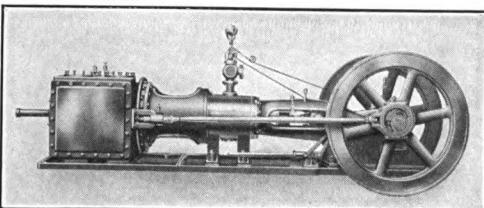
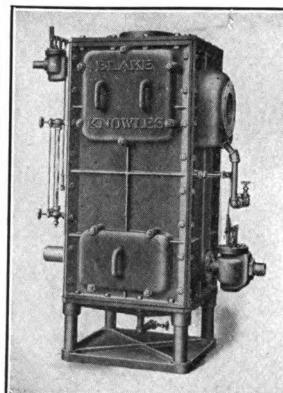
FACTORY: EAST CAMBRIDGE, MASS.



### FEED WATER HEATERS

Both Open and Closed Types

Sizes for all conditions of service



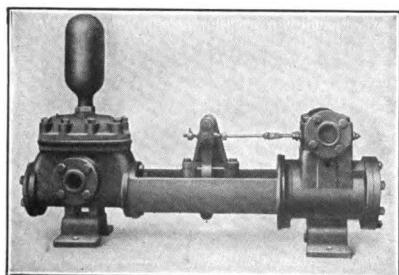
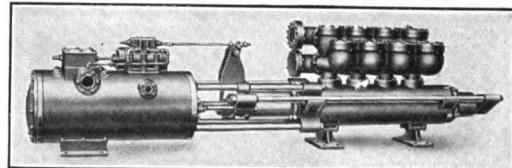
### ROTATIVE DRY VACUUM PUMPS

Steam and Power

For High Vacuum Service

### SINGLE COMPOUND PLUNGER PUMPS

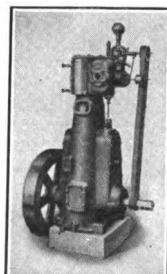
For Boiler Feeding, Elevator Service, Etc.



### VERTICAL HIGH SPEED STEAM ENGINES

Single or Double

For Pumping or Generating Service

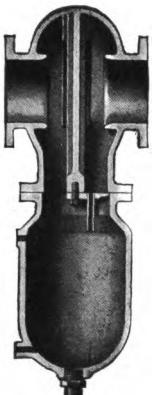


IMPROVED SIMPLEX PUMPS for Boiler Feeding, Pressure and Tank Service

## HARRISON SAFETY BOILER WORKS

3199 N. 17TH ST., PHILADELPHIA, PA.

COCHRANE FEED WATER HEATERS, COCHRANE STEAM AND OIL SEPARATORS, SORGE-COCHRANE HOT PROCESS SYSTEM OF WATER SOFTENING, COCHRANE MULTI-PORT SAFETY EXHAUST OUTLET VALVES.



Showing general construction of horizontal form of Cochrane Separator

**COCHRANE OIL SEPARATORS** installed in exhaust lines from steam engines thoroughly purify the exhaust steam of grease so that the steam can be used safely and heating water by actual contact, or in heating or drying coils, exhaust turbines, absorption ice machines and other apparatus, and so that the condensate from such apparatus may be returned and fed to the boiler, or utilized for industrial purposes. Over 10,000,000 H.P. of boilers are protected against oil by Cochrane Separators. Ask for a copy of our "Separator Talks."



Cochrane Horizontal Oil Separator

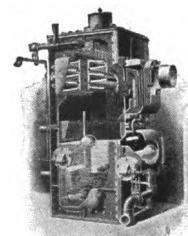
**THE COCHRANE OPEN FEED WATER HEATER** serves as a receptacle in which the boiler feed is heated to the full temperature possible by means of exhaust steam. Spraying the water through the steam bath of the heater drives off air and gases (rendering the water non-corrosive) and brings about the precipitation of scale-forming carbonates. The Cochrane Heater also performs the functions of an automatic make-up water regulator, feed-water skimming tank and filter, oil separator and expansion or muffle tank. Cochrane Heaters are made in all sizes, up to 20,000 H.P. Our catalog of "Cochrane Heaters and Their Use in Condensing and Non-Condensing Steam Power Plants," at your request.

**COCHRANE STEAM SEPARATORS** protect engines, turbines or pumps from damage by water brought over from the boiler by priming, or condensed in pockets in the steam line. They also remove the small percentage of water or moisture always present in steam, thereby permitting the saving of from 25 to 50% of the cylinder oil, while obtaining better lubrication with less friction and wear. The removal of the water from steam used by turbines results in improved economy, and reduces blade erosion. Full particulars, sizes and dimensions are given in our "Separator Catalog."

**COCHRANE RECEIVER SEPARATORS** are distinguished by extra large wells or receivers, which not only provide storage for large volumes of water until drained away by the trap, but also act as reservoirs for steam, and, being placed close to the engine throttle, equalize pulsations in the steam line and maintain a higher average pressure in the steam chest, while permitting the use of smaller piping and fittings, which are less expensive in first cost, maintenance and loss of heat by radiation. Write for Engineering Leaflet No. 10 on "Recent Developments Affecting the Use of Separators in Connection with Live and Exhaust Steam Piping."



Cochrane  
Horizontal  
Receiver  
Separator



Interior view of Cochrane Open Feedwater Heater

## HARRISON SAFETY BOILER WORKS

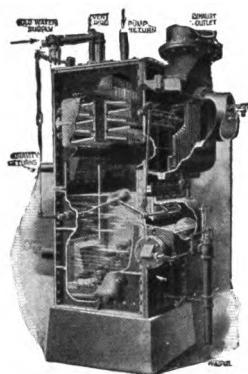


Heater with Extra Large Capacity  
for Storing Hot Water

**COCHRANE HORIZONTAL CYLINDRICAL HEATERS** are especially adapted for situations where headroom is limited, or where it is desired to provide large water storage volume.

**COCHRANE HEATERS EQUIPPED WITH EXTRA LARGE STORAGE CAPACITY** are supplied to paper mills, tanneries, textile mills, and other plants wherein the storage of hot water in large quantities is required.

**COCHRANE STEAM-STACK AND CUT-OUT VALVE HEATERS AND RECEIVERS** save from \$50 to \$500 on the first cost of equipping plants where the surplus exhaust steam not required in heating the boiler feed water is utilized in exhaust steam heating or drying systems or in low-pressure turbines or absorption ice machines. The extra large separator attached to the heater is of sufficient capacity to purify of oil all steam exhausted by engines, pumps, etc., thus saving the cost of an independent separator with trap in a by-pass around the heater. Valves incorporated in the application of this heater in connection with the leading commercial exhaust steam heating systems is explained in our "Exhaust Steam Heating Encyclopedia," sent upon request.



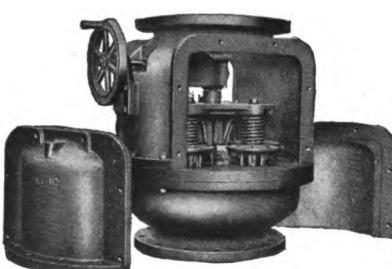
Cochrane Steam-Stack and Cut-Out Valve Heater and Receiver  
(Patented)

required, there being no heavy weights to lift. Send for *Engineering Leaflet No. 11.*

### ENGINEERING SERVICE

Write us concerning the conditions in your plant, and the changes contemplated, and we shall be glad to give suggestions as to the best arrangement of apparatus to secure the results desired. We have had twenty years of experience with steam plants aggregating 10,000,000 H. P.

Address Eng. Dept., Harrison Safety Boiler Works, 3199 N. 17th St., Phila., Pa.



Cochrane Multiport Safety Exhaust  
Outlet Valve  
(Patented)

## THE NATIONAL PIPE BENDING CO.

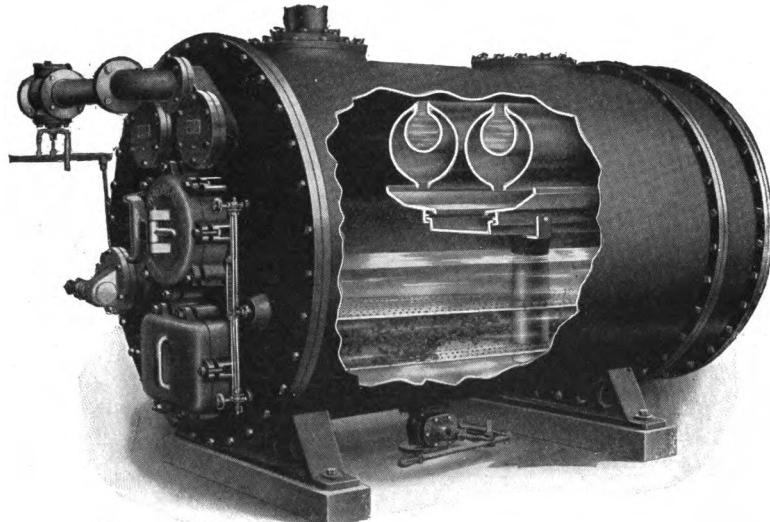
Boston Office  
54 High Street

Main Office and Works  
NEW HAVEN, CONN.

New York Office  
149 Broadway

THE NATIONAL COIL OR CLOSED FEED-WATER HEATER. THE NATIONAL DIRECT CONTACT FEED-WATER HEATER AND PURIFIER. NATIONAL STORAGE HEATERS, NATIONAL STEAM AND OIL SEPARATORS, COILS AND BENDS OF IRON, BRASS AND COPPER PIPE.

### THE NATIONAL DIRECT CONTACT FEED-WATER HEATER AND PURIFIER



#### METHOD OF TRANSMITTING HEAT FROM EXHAUST STEAM TO THE WATER

From a regulating valve, the water enters a manifold cast on the front head of the heater which serves as a distributing chamber to the contact pipes, which consist of a double cast-iron pipe cast together one within the other, and closed at opposite ends.

The Water Pipe (A) has a port extending its full length upwards to the outside surface of the steam pipe with vertical walls isolating one from the other.

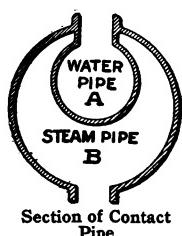
The Steam Pipe (B) has a port its full length at the bottom, through which all the steam must pass to enter the Heater.

The water entering the water pipe flows upward through the port and passes in a thin film over the entire outer surface closely all the way around, until it reaches a rib projecting from each side of the port opening at the bottom of the steam pipe, where it is broken up into two sheets of fine spray.

The steam after passing through the Oil Separator enters the steam pipe, and the only outlet for the steam is the port at the bottom.

The Cold Water Pipe, being inside of the Steam Pipe, is surrounded by steam and the coldest water and hottest steam are first brought together through contact with the thin walls of the Water Pipe, then the pre-heated water is

further heated as the thin film of water passes over the outer surface of the steam pipe, and finally all of the water and all of the steam are brought into direct and actual contact.



# THE NATIONAL PIPE BENDING CO.

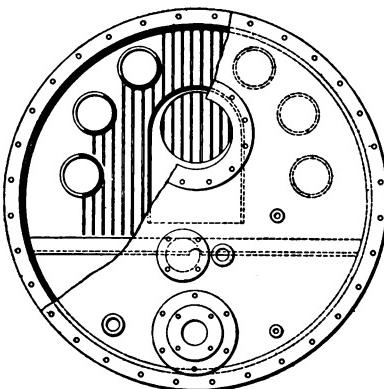
## THE OIL SEPARATOR

The Oil Separator is part of the Heater and forms the back head and is of the same diameter as the shell. It is of the gravity type, having a multi-ported baffle plate, each port having an individual baffle.

These individual baffles are obtained by having an opening in the back of pipes which extend from the ports in baffle plate to the outer wall of the Separator. They absolutely prevent oil from being carried into the heater. The large cubical capacity of the Separator not only insures the effective separation of oil from the exhaust steam, but it also overcomes the pulsations of exhaust and gives an even flow of steam to the heater.

### FILTRATION

Upward filtration is used. A large sediment chamber in the bottom of heater relieves filter bed of unnecessary work. A quick-opening blow-off valve on outlet from sediment chamber affords opportunity for draining heater and also causes a reverse current through filter bed, giving it longer life.



Oil Separator (Part of the Heater itself)



Patent applied for

## THE NATIONAL HORIZONTAL OIL SEPARATOR

This Separator absolutely removes the grease or cylinder oil from exhaust steam so that the steam, when condensed, is perfectly suitable for boiler feed, laundry, or dye house service, ice making, or any other similar purpose.

Note the multi-ported baffle plate, each port having an individual baffle, a distinctive feature found only in the National Separators.

## Feed Water Heaters

# THE SIMS COMPANY

ERIE, PENNSYLVANIA

POWER PLANT APPLIANCES, FEED WATER HEATERS,  
HOT WATER GENERATORS, ETC.

We issue catalogs covering our large variety of sizes and product and we incorporate valuable data for the use of the engineer. Column A of table below gives catalog number, Column B the maximum usual pressure for the apparatus, Column C the sizes made.

A	STOCK TITLE	B	C
TH2	Tubular (or closed) Feed Water Heaters. See Figs. 6 and 7.....	150	25
OH2	Open Feed Water Heaters and Purifiers. Fig. 5.....	15	15
G2	Hot Water Generators (For heating water).....	50	25
M2	Sheet Iron Exhaust Heads. Fig. 2.....	?	21
M2	Cast-Iron Exhaust Heads .....		16
M2	Boiler Compound Feeders.....	150	5
	SugarJuice Heaters.....	50	10
SS2	Steam Separators—Vertical, See Fig. 1. Horizontal, See Fig. 4.....	150	13
M2	WaterSofteners.....	150	2
M2	Oil Separators. Fig. 3.....	20	16
M2	Oil Filters.....		11
M2	Boiler Cleaners.....	150	3
M2	Low Water Alarms.....	150	1
G2	Convertors (For heating by hot water).....	50	25

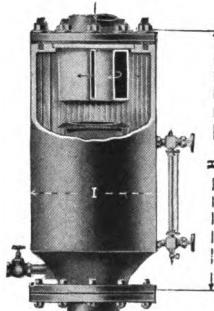


Fig. 1

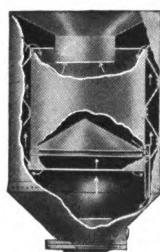


Fig. 2



Fig. 3

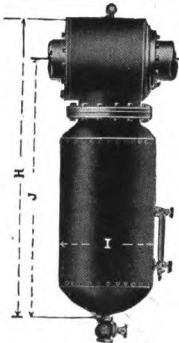


Fig. 4

Table for Fig. 5

D	E	F	O	H	I
4	200	8	1½	87	25
5	300	8	1½	73	29
6	400	10	2	90	29
7	500	10	2	92	35
8	600	12	2	104	35
9	800	14	3	73	43
10	1000	14	3	96	43
11	1200	16	3	112	43
12	1500	16	3	133	43
13	2000	20	4	168	43
14	2500	20	4	122	64
15	3000	22	5	145	64

Table for Fig. 1

Dia. Pipe K	H	I
2½	16	8½
3	19	10½
3½	19	10½
4	20	12
4½	20	12
5	22	14
6	23	15
7	30	16½
8	30	21
9	33	22
10	33	23
12	34	24

Table for Fig. 4

Dia. Pipe K	H	I	J
3	39½	12	34
3½	39½	12	34
4	42	14	36
4½	42	14	36
5	49	16	42
6	55½	18	48
7	64½	22	56
8	70½	22	60
9	81	26	70
10	87½	26	76
12	96	30	84

NOTE. Smaller sizes are made in all the apparatus given in tables and several variations from each type are possible to suit conditions.

## THE SIMS COMPANY

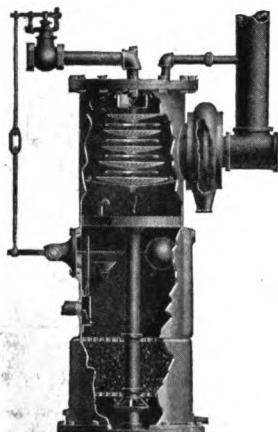


Fig. 5

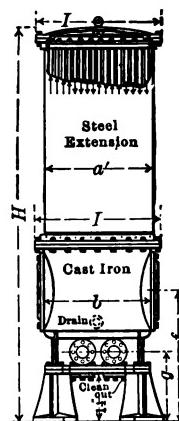


Fig. 6



Fig. 7

NOTE. The index letters given in the table refer to the dimensions given on the various apparatus illustrated above. Column D = Stock number. Column E = Horse Power Rating. Column F = Dia. of Exhaust. Column G = Water Connections. Column H = Total Height. Column I = Greatest Diameter. Column O = steam supply. All dimensions in inches.

TABLE FOR FIGURES

D	E	F	G	H	I	a'	e'	f	g	h
10	200	8	2	66	25	17		24 $\frac{1}{2}$	12	26
11	250	8	2	78	25	17		24 $\frac{1}{2}$	12	35
12	300	8	2 $\frac{1}{2}$	90	25	17		24 $\frac{1}{2}$	12	57
13	400	10	3	87	30	20		32	15	35
14	500	10	3	99	30	20		32	15	47
15	600	12	3	111	30	20		32	15	59
16	700	12	3	123	30	20		44	15	59
17	800	14	4	103	43	37	48 $\frac{1}{2}$	40		20
18	900	14	4	111	43	37	56 $\frac{1}{2}$	40		20
19	1000	14	4	119	43	37	64 $\frac{1}{2}$	40		20
20	1200	16	4	139	43	37	84 $\frac{1}{2}$	40		20
21	1500	16	4	166	43	37	112 $\frac{1}{2}$	40		25
22	2000	20	5	167	48 $\frac{1}{2}$	41 $\frac{1}{2}$	99	50		26 $\frac{1}{2}$
23	2500	20	5	195	48 $\frac{1}{2}$	41 $\frac{1}{2}$	127	50		26 $\frac{1}{2}$
24	3000	22	5	210	48 $\frac{1}{2}$	41 $\frac{1}{2}$	148	50		26 $\frac{1}{2}$
25	4000	22	6	260	48 $\frac{1}{2}$	41 $\frac{1}{2}$	191	50		26 $\frac{1}{2}$

## FETTA WATER SOFTENER CO. RICHMOND, INDIANA

THE FETTA SYSTEM OF WATER SOFTENING  
FOR POWER PLANTS, LAUNDRIES AND DOMESTIC USE

This system consists of our regular equipment of tank, filters, economizer, stick chemical feeder and feed water control. We also show in the illustration a feed water heater attached. Where no steam is available, this system also treats water cold. There are, however, many decided advantages in the hot process.

The distinctive and superior features are:

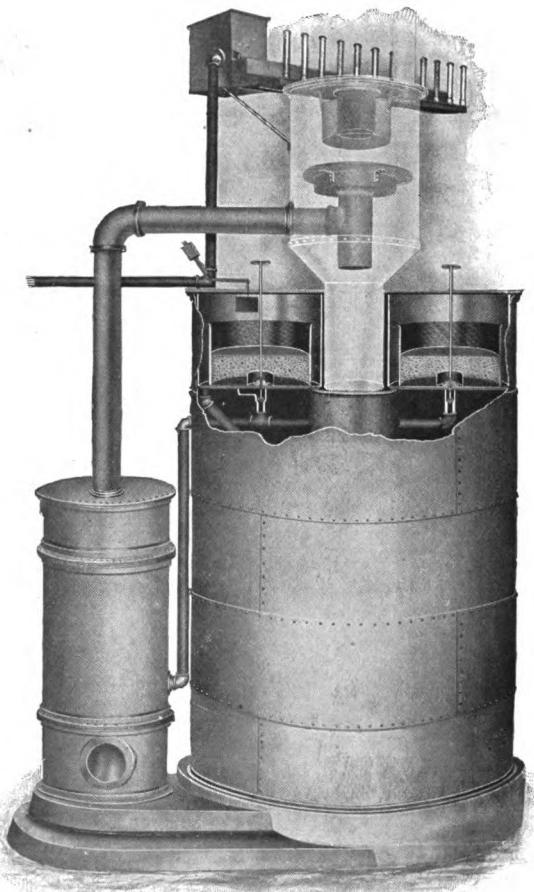
- (a) *The Stick Chemical Distributor.*
- (b) *The Well Arranged Precipitating Tanks.*
- (c) *The Permanent Quartz Sand Filters.*
- (d) *The Fetta Feed Water Control.*

By this arrangement we produce soft water with the least possible amount of chemicals and deliver the water at temperatures as high as 180° F. This means economy in size of plant, amount of chemical, and fuel consumed.

The supply of cold water is intermittent, thus making possible a proper settling of precipitated impurities, but the delivery of soft water is continuous. This system therefore combines the advantages of the "Intermittent" and "Continuous" systems.

It is an established fact that scale forming salts in hard water are more readily acted upon by chemicals, and thrown down, when the water is at a high temperature, than when treated cold. This means that the action is more rapid and complete, and that the treating can be made much smaller than would otherwise be possible, at the same time giving better results. All of these advantages are secured in the Fetta System.

Complete information regarding the Fetta System of Water Purification, and Bulletins describing special features mailed on request.

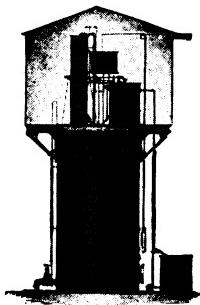


The Fetta Economizer System

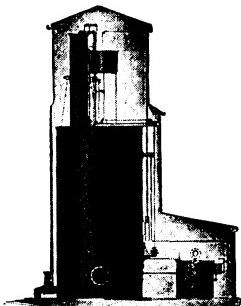
## WM. GRAVER TANK WORKS

209 LA SALLE ST., CHICAGO, ILL.

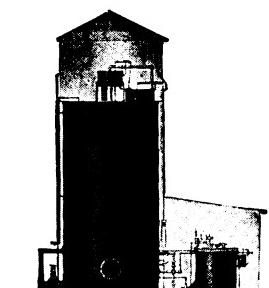
BARTLETT-GRAVER WATER SOFTENER AND PURIFIER FOR GENERAL BOILER,  
INDUSTRIAL AND DOMESTIC PURPOSES. STEEL TANKS AND PLATE WORK



Type AG.



Type BW.



Type B.

In softening and purifying water the BARTLETT-GRAVER WATER SOFTENER and PURIFIER uses the standard "Porter-Clark" process which consists of adding lime and soda ash to the hard water to precipitate the hardening ingredients. These precipitated solids are removed from the water by sedimentation and subsequent filtration.

The apparatus is automatic and continuous, the chemical being added to the water in proportion to the amount of water treated, the flow of the water being uninterrupted and the amount of water entering the system being the same as the amount of softened water withdrawn.

The chemicals are used in the form of suspension and are prepared once in twelve hours. They are accurately proportioned by means of the Bartlett-Graver Displacement System in which no mechanical device comes in contact with the chemicals. To this feature is due the accuracy of the apparatus.

The precipitated solids fall to the bottom of the settling tank from where they are periodically withdrawn through the sludge piping. A filter is located at the top of the settling tank to remove any precipitate which does not settle.

The softener is built with two types of filter depending upon the class of service demanded. Excelsior is used as a filtering medium in one type and crushed quartz in the other. The quartz filter is equipped with reverse air wash system which automatically removes the accumulated sludge.

The apparatus is built in four types, the difference between them being the position of the chemical tank and the source of power. In type "A" the power is derived from a water wheel operated by the incoming water, the chemical tank being located at the top of the apparatus. Type "AG" is the same with the exception of a second chemical tank being located upon the ground level. In type "BW" the chemical tank is located upon the ground level, all power for agitating and pumping the chemical being derived from an over-shot water wheel which is connected by vertical shaft to the lower operating parts. In type "B" the chemical tank is located upon the ground level, the power necessary to drive the apparatus being derived from either an electric motor or small engine.

A complete catalogue thoroughly describing this apparatus will be mailed upon request.

## THE KENNICOTT COMPANY CHICAGO HEIGHTS, ILL.

Sales Office  
14th Floor Corn Exchange Bank Building,  
Chicago, Ill.

Eastern Office  
50 Church Street,  
New York, N.Y.

**WATER SOFTENERS FOR THE TREATMENT OF WATER FOR BOILER FEED PURPOSES, FOR RAILROADS AND INDUSTRIAL PLANTS, FOR THE USE OF LAUNDRIES, TANNERIES, DYE WORKS, AND ANYWHERE WHERE A SOFT, CLEAR WATER IS OF ADVANTAGE.**

### DESCRIPTION OF OUR TYPE "K" WATER SOFTENER

The type "K" KENNICOTT WATER SOFTENER, a sectional view of the same being shown at the right of this description, represents the many years' experience which THE KENNICOTT COMPANY has had in WATER SOFTENING.

In order to have a perfect water softener it is necessary to have a machine that will automatically treat varying quantities of water with varying quantities of materials, and which will require the least possible amount of attention and soften a water at the lowest possible cost. This has been accomplished in our type "K" machine.

This machine is continuous in its action, automatically starting and stopping with the beginning and ceasing of the flow of the water into the softener. The water is pumped but once into the softener, and it is delivered at the top. The water as it flows into the softener furnishes all the power the apparatus requires, both for mixing the chemical reagents of the water to be purified as well as for operating automatically all the mechanism of the apparatus. One great particular advantage of this machine is that the parts *REGULATING* the feed of chemicals do not come in contact with the chemicals and, therefore, cannot be subject to stoppage and cannot in any way be affected by the chemicals.

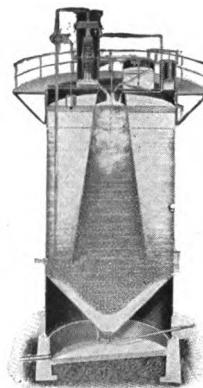
The conical down-take in the softener, and thorough mixing which the water receives in the top of the down-take is of the greatest possible advantage in reaction and sedimentation. By the above means the water becomes quiet as quickly as possible after being thoroughly mixed with the chemicals. The softeners are designed so that the rate of flow in inches per hour is low and sedimentation, therefore, takes place very rapidly.

The softeners are designed to be either top operated, where it is necessary to economize on ground space, or all the chemical mixing and feeding tanks can be located on the ground.

Many machines of both types can be seen in operation and have been in operation for several years.

This type "K" softener has been built in every size from 150,000 gallons of water per hour to 500 gallons of water per hour. The largest CONTINUOUS STEEL TANK SOFTENER in the world having been built and installed by THE KENNICOTT COMPANY. All our experience has been directed towards building a machine which is guaranteed to produce uniform results and WE HAVE MADE GOOD.

We publish a full description of the operation of this type "K" softener which gives detailed information and also gives photographs of many of the softeners which have been installed for some of the best known firms and railroads in this country and abroad. They cover almost every line of business. The matter referred to will be mailed you upon request.



# **REISERT AUTOMATIC WATER PURIFYING COMPANY**

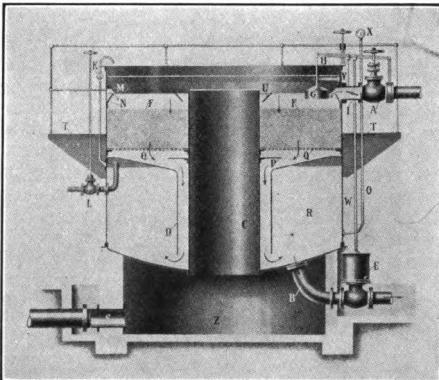
**30, CHURCH STREET**

## NEW YORK CITY

# **WATER FILTERS, WATER SOFTENERS, AND IRON ELIMINATING APPARATUS**

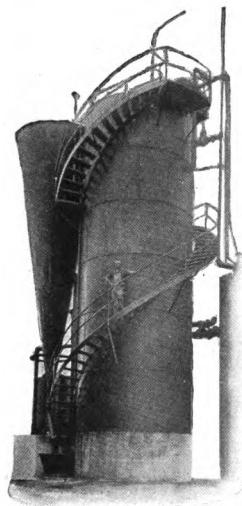
## **WATER FILTERS**

The new Reisert Patent Water Filters with air-impelled filtered water wash have in two years in many exhaustive tests demonstrated their complete superiority over the older filter systems. The patented automatic regulators maintain a constant rate of filtration and indicate when the filter must be washed. The whole equipment is so simple and compact that cost of operation is reduced to a minimum, while the outlay for repairs is negligible. These filters are made in circular units in steel and in rectangular units in concrete. We also design coagulating and sterilizing plants when needed for the most efficient operation of the filters.



## **WATER SOFTENERS**

Hans Reisert was one of the first water purification experts in the world to design successfully a continuous automatic water softener. His long experience has evolved a machine remarkable for its simplicity, efficiency in the constant uniformity of the purified water, and economy in initial cost and maintenance. All moving parts are eliminated, the entire operation of the softener being effected by the gravity flow of the water. The several types of Reisert apparatus use the lime-soda, lime-barium, and caustic soda methods of treatment, depending upon the requirements of the individual water. All the Reisert softeners have embodied Reisert Gravel Filters which are easily washed by means of air and water, and are practically indestructible. The Reisert softener can be charged with chemicals without interruption of the delivery of softened water. The operation of washing the filter requires only about 5 minutes per 24 hours.



## IRON ELIMINATING APPARATUS

The Reisert Type FO apparatus for the elimination of iron from ground waters, is an exceedingly simple device, operating entirely automatically and absolutely without chemicals. It effects a complete removal of iron and delivers a clear sparkling water fit for use in all processes. The only attendance this apparatus re-

any textile or chemical process. The only attendance this apparatus requires is the periodic washing of the filter.

More than 5,000 Reisert Water Softeners and Filters are in operation throughout the world.

LOOMIS-MANNING  
FILTER DISTRIBUTING COMPANY  
PHILADELPHIA, PA.

Branch Offices:

New York, Chicago, Boston, Buffalo, Baltimore, Washington

Loomis-Manning Filters are designed with three essential features in view:

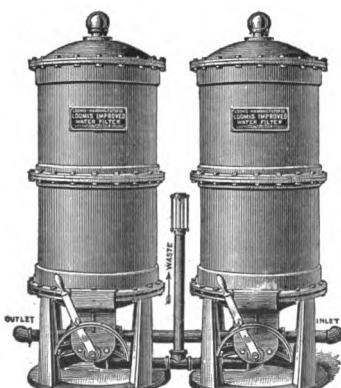
**Efficiency:** This, in a filter, means the ability to thoroughly cleanse the filter bed each time it is washed. For unless the filter bed is kept broken up, free from lumps of all kinds which form around the gelatinous mass which has been collected by the filter bed, the effectiveness of the filter will become less and less until it is nothing. By the reverse flow of the water, the filter bed of a Loomis-Manning Filter is caused to pass up and down through the Loomis Cutting Plate which breaks up the mass of accumulated impurities so that they are purged from the bed and carried off into the waste. The entire bed is in motion, becoming cleansed, at each washing. No part of it is so heavy that it lies stagnant. The bed is a uniform grade of material from top to bottom.



**Simplicity:** The Manning Single Controlling Valve takes the place of five gate valves and also prevents all chance of errors. By moving one lever to four stations, plainly marked on a dial, the action of the filter may be either filtering, washing the filter bed, filtering to waste (sometimes called re-washing) or the filter may be by-passed. A sight glass is provided so that it is possible to see the quality of the filtered water and watch the cleansing of the filter bed, preventing an extravagant use of water for washing.

**Durability:** The cylinders and heads are close grained cast iron, to obtain the maximum durability. All materials coming into contact with water are selected to resist corrosive action. Bronze controlling valve, tinned copper screen plates, brass studs, galvanized iron or brass pipe and fittings, etc., reduce repairs to a minimum.

**Essential Details:** The filter bed rests on tinned copper screen plates, extending under its entire area, bringing about a uniform collection of the filtered water and a uniform distribution of the washing water, insuring a thorough cleansing. The Loomis Confining Plate extends across the filtering chamber near the top and prevents all fish, sticks, stones, etc., from entering and becoming a permanent part of the filter bed. These screen plates are sand tight, preventing any loss of the filtering material into pipe lines, pumps, etc. Baffles are provided in the top and bottom heads to distribute the water as it enters for filtration or for washing. Ample space is provided to enable the bed to wash properly. The coagulant, if necessary, is fed by our indirect method, accurately controlled.

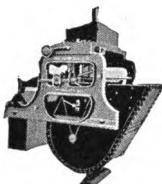
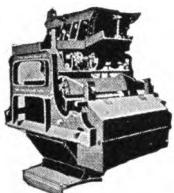


Send for List of Installations.

# AVERY SCALE COMPANY

NORTH MILWAUKEE, WIS.

## AUTOMATIC WEIGHING AND RECORDING MACHINERY



Coal and Water Scales

### THE AVERY COAL AND WATER WEIGHERS

These scales have been specially designed to weigh both coal and water. They automatically weigh and register every pound of coal or water passed through them. They are made in all sizes to weigh any desired quantity per hour.

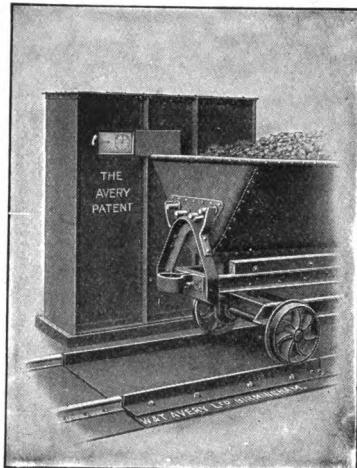
### TRUCK TOTALIZER

This scale automatically weighs all cars passing over the platform and registers the net weights upon our patent counter, so that the total for any period can be immediately ascertained. The number of trucks weighed is also recorded upon a separate counter.

About one-fourth horse-power is required to operate this mechanism, and the weight of the car upon the platform automatically starts the weighing mechanism.

Empty cars passing over the platform do not affect the scale.

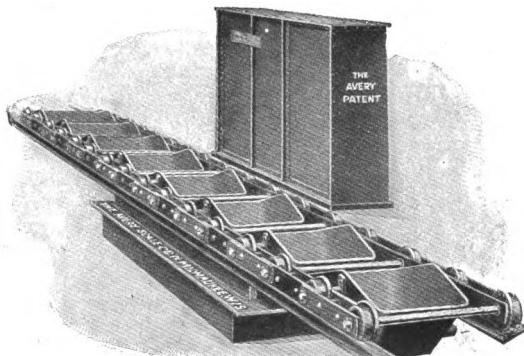
This scale can be fitted if desired with Avery's Patent Printing Apparatus, by means of which the individual weights are printed on a tape or ticket.



Truck Totalizer

### CONVEYOR SCALES

This automatic conveyor scale will continuously weigh, record and total the weight of coal travelling upon any type of conveyor.



Conveyor Scales

## BUILDERS IRON FOUNDRY

PROVIDENCE, R. I.

VENTURI METERS FOR COLD WATER, HOT WATER, BRINE, CHEMICAL SOLUTIONS, SEWAGE, STEAM, GAS AND AIR; GLOBE SPECIAL CASTINGS FOR WATER WORKS; GRINDING MACHINERY; POLISHING MACHINERY.



A complete VENTURI METER consists of a Venturi Meter Tube and a Register or other Instrument.

The METER TUBE is set directly in the pipe line.

The REGISTER may be set at a considerable distance from the Meter Tube to which it is connected by two small pipes transmitting pressure only.

The Instrument shown by the cut has three dials: The upper dial makes a continuous graphical chart record of previous rates of flow. The middle dial shows the total quantity of water which has already passed. The lower dial shows the exact rate of flow at the moment of observation.

A VENTURI METER in the discharge main from any kind of a Pump is the best possible check upon its performance.

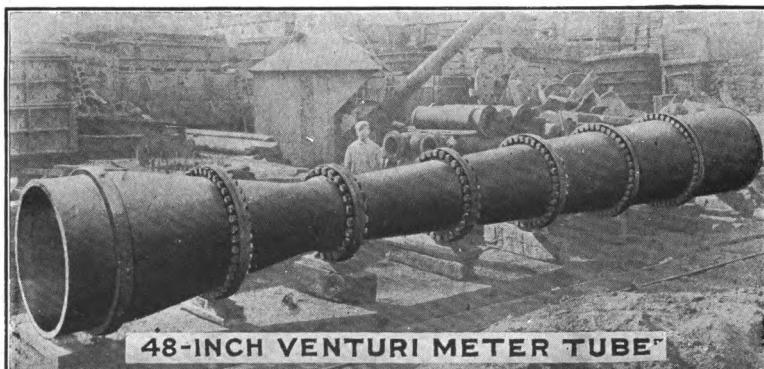
With CENTRIFUGAL PUMPS it shows whether the makers' guarantee has been met and whether there is subsequently any falling off or improvement. It enables tests to be made at any time to determine the most efficient combination of speed and head. It shows whether the impeller becomes worn or partially clogged with debris.

With RECIPROCATING PUMPING ENGINES it is an unquestioned arbiter during the official acceptance duty test. It shows the exact percentage of "slip" and indicates when the rubber pump valves should be renewed. It shows whether "short-stroking" of piston travel is excessive.

With BOILER FEED PUMPS it enables the engineer to determine the "evaporation," (pounds of water per pound of coal). It can accurately measure extremely hot waters as there is nothing to wear out or get out of order.

Special VENTURI METER TUBES and Special INSTRUMENTS are furnished when the conditions warrant them. For instance, the cones of the Meter Tube are sometimes constructed of sheet steel, wood staves, reinforce concrete, etc. Bulletin No. 71 describes four very special 34 inch Tubes at Wachusett Dam, Metropolitan Water Works, Boston, Mass. Bulletin No. 72 describes three 17 ft. 6 inch diameter Meter Tubes with reinforced concrete cones on new Catskill Aqueduct Supply for New York City.

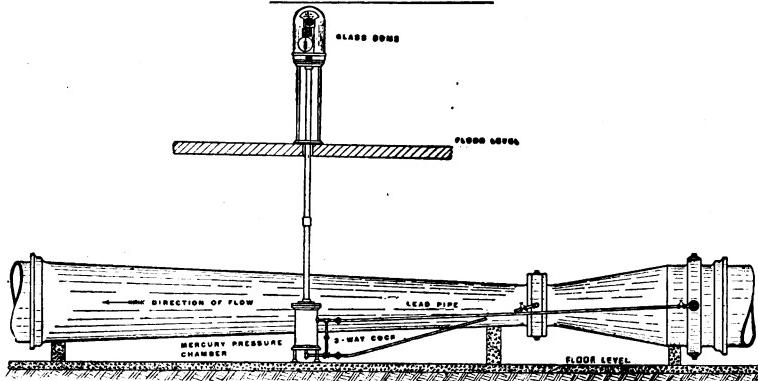
Descriptive Bulletins sent upon request.



48-INCH VENTURI METER TUBE

## SIMPLEX VALVE AND METER CO. PHILADELPHIA, PA.

VENTURI AND PITOT TUBE METERS, RATE OF FLOW CONTROLLERS; LOSS OF HEAD, RATE OF FLOW, AND WATER LEVEL GAUGES, ALTITUDE VALVES FOR RESERVOIRS AND RAILROAD WATER TANKS, AUTOMATIC AIR AND VACUUM VALVES. CHEMICAL FEED DEVICES, AND OTHER HYDRAULIC APPARATUS OF SPECIAL DESIGN.



Standard setting for low pressure type where Piezometric level of water in main is below desired location of meter register

### SIMPLEX TYPE "G" WATER METER

Our type "G" Simplex meter, which is thoroughly covered by pending United States patents, is based on the principles discovered in 1904, finally perfected in 1909 and fully developed and tested out in 1910. The important features are the ability to measure all flows from zero to any desired maximum without theoretical or practical limitation.

It consists of some form of orifice such as a Venturi Tube, pitot tube in a water main, any form of conduit, or canal, and having suitable pipe connections therewith. The apparatus consists of a mercury float chamber, and resting therein a float of such variable cross section that its movement is in direct ratio to the flow of water through the Venturi tube, pipe, conduit, or canal. The movement of the float actuates a revolving shaft to which is attached a hand pointing to a fixed dial with uniform graduations. Attached to the shaft and moving in proportion to the angular deflections thereof is a pen in contact with a rectangular chart wrapped on a revolving cylinder; also a traction wheel, which passes over the face of a revolving disc, said traction wheel being geared to a train of wheels operating a series of small dials similar to that of a house gas or water meter. Both the cylinder and the disc are operated by an eight day marine clock.

### SIMPLEX RATE-OF-FLOW CONTROLLERS

This apparatus is designed for service in a water pipe or conduit through which the rate of discharge must be maintained uniform, regardless of the pressure or head on the up or down stream side of the valve. It consists of a perfectly balanced valve, operated by a diaphragm, a Venturi section or tube, and means whereby the diaphragm is actuated by the difference in pressure between the full and contracted sections of the Venturi tube. The diaphragm and valve are balanced by an adjustable counterweight, which, when set for any required rate of flow, will hold the valve discs in the proper position for that flow.

In every well-regulated filter plant, wherein rate controllers are used, it is the invariable custom to also provide for loss-of-head and rate-of-flow gauges. To adjust our controller, it is only necessary to watch the rate-of-flow gauge and move the counterweight so as to produce the rate of flow desired, after which the mechanism will automatically maintain this rate until the counterweight is readjusted. Where rate-of-flow gauges are not used, the graduation on the scale beam can be used for this purpose.

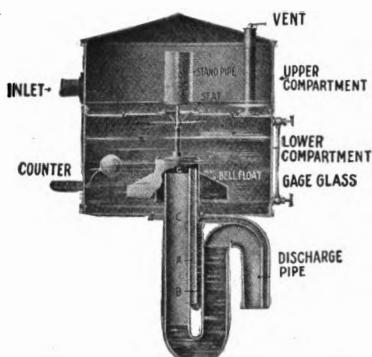
Complete catalogs on request.

## Water Weighing Machines

# WILLCOX ENGINEERING CO., Inc.

SAGINAW, MICHIGAN, U. S. A.

### THE WILLCOX WATER WEIGHER.



Vertical Section of the Willcox Water Weigher Style A

release of the entrapped air—an extremely accurate method of balancing.

**Accuracy:** Each weigher is guaranteed to weigh within one per cent. of absolute accuracy at any rate of supply up to its maximum capacity and at any temperature from freezing to boiling.

**Styles and Capacities:** The Willcox Water Weigher is built in several styles to suit various requirements, and in all capacities from one thousand pounds per hour up to half a million pounds.

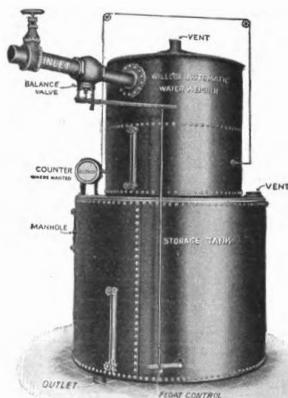
**Plans for Installation:** Suggestions, sketches and plans for proposed installations are furnished free of charge by the Willcox Engineering Company. We have competent engineers and draftsmen for the purpose of assisting prospective customers in planning suitable arrangements to meet local conditions.

**Savings Secured in Boiler Plants:** By furnishing a simple, reliable, automatic, self-recording device for continuously and accurately recording every pound of water pumped to the boilers, the Willcox Water Weigher offers a means of segregating boiler evaporation cost from engine and generator costs, thereby giving a sure means of determining from day to day whether or not a proper evaporation is being secured per pound of coal.

### GENERAL DIMENSIONS—STYLE A BUILT OF BOILER PLATE

Size No.	Maximum rate of weighing, in lbs. of water per hour	Size Inlet, In.	Shell Thickness	APPROXIMATE	
				Ship's Weight	Weight of water per unit charge
1	500,000	10	3/8	4000	5000
2	400,000	8	3/8	3600	...
3	300,000	8	1/4	3000	3500
4	250,000	6	1/4	2600	...
5	200,000	6	1/4	2100	2700
6	175,000	6	1/4	2000	...
7	150,000	6	1/4	1850	2250
8	125,000	6	1/4	1700	...
9	100,000	6	1/4	1500	1800
10	87,500	4	1/4	1350	...
11	75,000	4	1/4	1200	...
12	62,500	4	1/4	1100	1180
13	50,000	4	1/4	1000	...

Illustrated Catalog No. 3 sent on request.



The Willcox Automatic Water Weigher with Storage Tank. Style A

## *Automatic Weighing, Packing, and Sealing Machinery*

# AUTOMATIC WEIGHING MACHINE COMPANY

Office and Factory

134 COMMERCE ST., NEWARK, N. J., U. S. A.

Western Office : 439 Pierce Bldg., St. Louis, Mo., U. S. A.

Cable Address : AWMCO

### AUTOMATIC WEIGHING, PACKING AND SEALING MACHINERY

ADAPTED TO THE USE OF MANUFACTURERS AND PACKERS OF SUGAR, COFFEE, SPICE, CLOTH, WASHING POWDER, BAKING POWDER, STARCH, SEEDS, CEREALS, GRAINS, FLOUR, WHEAT, ROLLED OATS, SALT, FERTILIZERS, COTTONSEED MEAL, LIMESTONE AND SHALE, CLINKER AND GYPSUM.

---

#### TO ENGINEERS

The best results and the highest efficiency accomplish their ends by the simplest and most direct means.

All of our machines are constructed with the idea of long life and efficiency, and an opportunity to describe them more fully than the space here allows would be appreciated.

The automatic weighing scale is now a recognized necessity in manufacturing, whether for packing packages, bags or boxes, proportioning two or more materials in a mix or checking bulk goods going from point to point; but that scale to be valuable must be capable of doing its work daily, and with precision, so if you are looking for those machines which give you the highest results, all other conditions being taken into consideration, we will have the pleasure of a more direct communication.

#### TO MANUFACTURERS

Our pride is to fulfil the just expectations of the purchasers of our machinery. We believe in co-operation, finding such a relationship between ourselves and our customers the most profitable.

To those who are earnestly desiring to cut down to its lowest their ultimate cost, we know we can be of inestimable service, and upon examination of the various circumstances peculiar to any given case, will submit such propositions that any buyer is able to give our proposals careful and intelligent consideration, and form a comprehensive view of what we will undertake to do.

At infrequent intervals where we have found that for some reason, clearly indicated by us to our inquirers, we were persuaded the conditions would not make the use of our machinery truly profitable to the manufacturers and therefore to us, we do not fail to say so, rather than merit the displeasure of our customers by putting them to needless trouble and probable expense.

We, of course, put before anything else the fulfilling of all guarantees which are clearly stated in our proposals, and strive to do even a little better, so that when a balance is struck between us there remains something to our credit in the good opinion of our customers.

## *Boiler Tube Cleaners*

# THE WM. B. PIERCE COMPANY

43 N. DIVISION STREET,

BUFFALO, N. Y.

## TUBE CLEANERS AND FLUE GAS ANALYZERS

### THE DEAN BOILER TUBE CLEANER

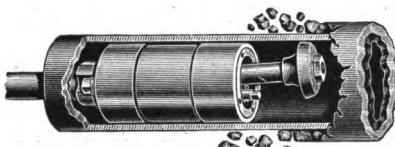


Fig. 1

For Removing Scale from Return Tubular  
Boilers

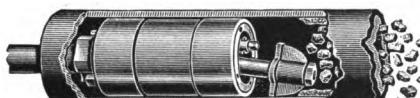


Fig. 2

For Removing Scale from Water Tube  
Boilers

The Dean is designed for removing scale from the tubes of water tube and return tubular boilers, locomotives, condensers and evaporators. For operating in the curved tubes of Stirling boilers and the Arch tubes of locomotives the cleaner is built shorter than the standard Dean and is barrel-shaped, thus permitting its passing around the bends.

The Dean is operated by air or steam and cleans from 10 to 30 tubes an hour. It removes scale by the well known principle of vibration. By a series of light, rapid taps, the force of which may

be regulated regardless of the pressure employed, it loosens the scale from the tube. In return tubular boilers the scale falls off in showers. In water tube boilers the loosened scale is broken into chunks by the cutting edges of the vibrator (see Fig. 2) and driven out by the exhaust.

In cleaning the tubes of water tube boilers the Dean will prove far superior to any other means in thoroughness of work and durability. And besides removing the scale it will remove the hard baked soot, which cannot be removed by any other means.

The same cleaner by changing vibrators may be used in water tube and return tubular boilers. At a small additional cost extra attachments making the cleaner suitable for operating in two or more different sizes can be furnished.

The Dean is a tube inspector as well as a tube cleaner and discloses leaks, but *does not* produce them.

It also shows the fallacy of the use of the compounds.

For further information write for Booklet No. 130.

We also manufacture Gas Analyzers for determining CO<sub>2</sub> O and CO.

Write for catalogue.

# THE UNITED STATES GRAPHITE CO.

SAGINAW, MICH., U. S. A.

**MINERS OF GRAPHITE AND MANUFACTURERS OF GRAPHITE PRODUCTS**

## U. S. G. CO.'S MEXICAN BOILER GRAPHITE

*Loosens Old Scale* by working through the minute cracks and checks (caused by the unequal expansion and contraction of metal and scale) and depositing itself on the inner surfaces of tubes and shell, with the result that the scale no longer adheres tenaciously and may be removed with comparative ease.

*Prevents Formation of Hard Scale* by its fine particles becoming distributed amongst the particles of scale. The graphite being a lubricant prevents the scale particles from adhering tightly to each other. The scale is thus kept in a loose condition and may be easily removed.

*Has No Chemical or Electrical Effect* because the action of graphite (which is carbon in its most inert form) is entirely MECHANICAL. This means that there will be no pitting of the boiler from chemical action or from electrolysis. Foaming cannot be caused by use of U S G CO'S MEXICAN BOILER GRAPHITE.

*Cannot Be Carried Over By the Steam.*

Being insoluble U S G CO'S MEXICAN BOILER GRAPHITE cannot under normal conditions pass out of the boiler with the steam. For certain industrial processes, such as Brewing, Laundries, Ice Plants, etc., this quality is very desirable and important.

*Is Equally Suitable For All Feed Waters.*

Since it acts MECHANICALLY instead of chemically, U S G CO'S MEXICAN BOILER GRAPHITE may be used successfully with any feed water. This does away with the expense of analyzing feed waters and keeping on hand a number of different compounds to suit different feed waters.



Only 14 lbs. of Soft Scale was found in a 300 h.p. Wickes Vertical Water Tube Boiler after Six Weeks' Operation without Cleaning. During this period U S G CO'S MEXICAN BOILER GRAPHITE was used regularly.



Sections of Old Scale Removed from a Feed Water Heater After Being Softened and Broken Down by U S G CO'S MEXICAN BOILER GRAPHITE.

*Not All Graphite Can Be Applied For This Purpose*, because the graphite used must not only be a very pure form of carbon but also of a nature suitable for lubrication. All formations of graphite are not pure carbon, nor are they all good lubricants. Moreover, graphite to work successfully in a boiler should be ground to an unusual degree of fineness to insure its constant circulation through the boiler. Besides it must be very, very fine in order to work into and disintegrate old scale. U S G CO'S MEXICAN BOILER GRAPHITE is such a product. It has a record and a reputation.

Put up in 100 lb. Kegs and Barrels (about 350 lbs.).

Send for Testimonials and Booklet "H."

## *Condensing Apparatus*

# THE ALBERGER COMPANIES

140 CEDAR ST., NEW YORK CITY

137 So. La Salle St., Chicago, Ill.

Farmers Bank Bldg., Pittsburgh, Pa.

Reeves & Skinner Machinery Co., St. Louis, Mo.

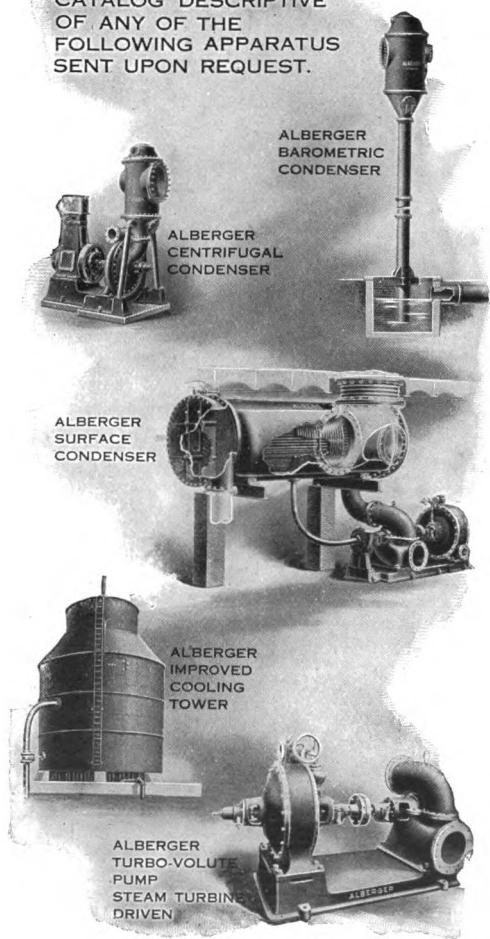
141 Milk St., Boston, Mass.

97½ Peachtree St., Atlanta, Ga.

C. F. Braun & Co., Inc., San Francisco, Cal.

HIGH VACUUM SYSTEM FOR STEAM TURBINES. SURFACE, BAROMETRIC AND CENTRIFUGAL CONDENSERS. COOLING TOWERS—VACUUM PUMPS—HEATERS

CATALOG DESCRIPTIVE  
OF ANY OF THE  
FOLLOWING APPARATUS  
SENT UPON REQUEST.



### ALBERGER APPARATUS

will be found in some of the largest power plants, mills and steel works in the United States.

### ALBERGER BAROMETRIC CONDENSER

This condenser is of the elevated jet type, the condenser cone being supported above a tail pipe approximately 34 ft. long, which removes the condensing water and water of condensation by means of gravity. A dry vacuum pump is used for removing the air and uncondensable vapors from the system. This arrangement reduces to a minimum the quantity of water required for condensing purposes.

### ALBERGER COOLING TOWERS

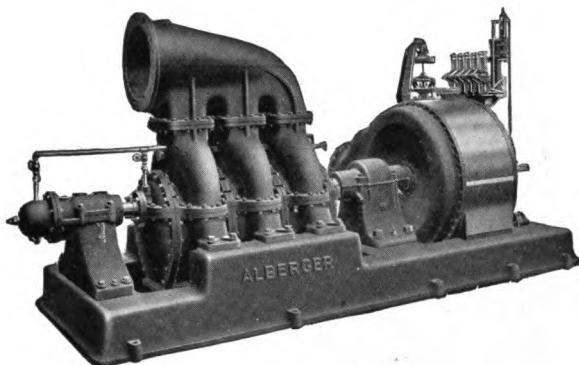
can be operated with either forced or natural draft and the convertible tower can be changed instantly from one to the other.

These towers artificially cool the water so that it can be continuously re-used in the condenser for condensing purposes, it being only necessary to supply a small quantity of water to make up the losses due to evaporation. These towers can be installed in cities, being placed upon roof structures when ground is not available. They are built in three types:—namely

Forced Draft  
Natural Draft  
Convertible.

## THE ALBERGER COMPANIES

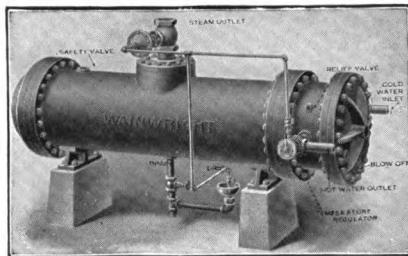
### ALBERGER PUMPS AND STEAM TURBINES



Alberger Curtis Pumping Engine.  
Multi-Impeller Turbine Type.  
Patents applied for.

### PUMPS THAT PUMP

Centrifugal and Turbine Pumps with Steam or Water Turbines. Any capacity. Any head. High efficiency. From Boiler Feed to Public Water Supply.



Wainwright Water Heater with Temperature Control.

Wainwright Corrugated Tube Heater for boiler feed.

The Wainwright Spiralflow heater for hot water service, hot water heating with forced circulation and automatic regulation. High rate of heat transmission by agitation of water and counter current flow. Cast iron, copper and brass insure long life for the Wainwright Heaters.

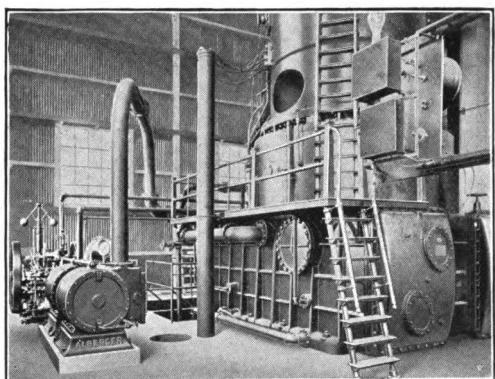
(See also next page)

## *Condensing Apparatus*

(Continued from preceding pages)

# THE ALBERGER COMPANIES

### ALBERGER BASE CONDENSERS



The base surface condenser is especially adapted to steam turbine conditions.

The barometric condenser of the combination counter current type makes a good outfit for a central station.

The centrifugal condenser is the simplest and most compact Jet condenser.

Self draining vacuum pumps take care of entrained water.

In the Alberger counter-current surface condenser the steam enters at the bottom, the air and uncondensable vapors are taken out at the top by means of a dry vacuum pump, the circulating water enters at the top, and passes through the tubes in a downward direction, coming out at the bottom. The water of condensation passes through the entering steam and is removed from the bottom of the condenser by means of a condensation pump.

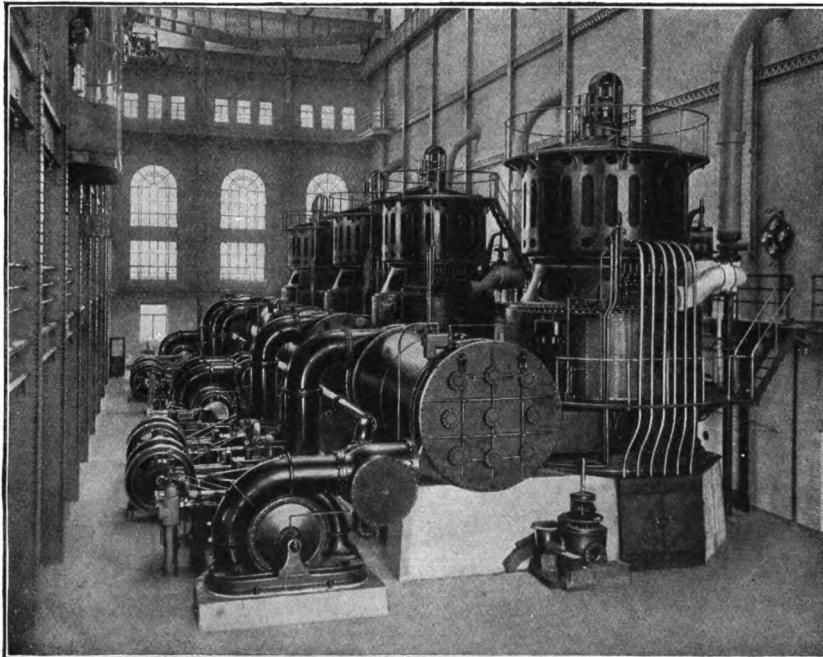
Which of the foregoing machines should be selected for any actual situation can only be determined by a careful study of the conditions. Proximity, elevation, and character of the water supply, cost of fuel, load factor, other power units in plant, periods of running, space available, and many elements must be considered by those familiar not only with the theory but with the practice of this branch of engineering to arrive at a selection that will prove most advantageous to the user.

Our experience is at your service.

## HENRY R. WORTHINGTON

115 BROADWAY, NEW YORK

SURFACE, BAROMETRIC AND CENTRIFUGAL JET CONDENSING SYSTEMS, COMPLETE WITH AUXILIARIES FOR HIGH VACUUM WORK:—COOLING TOWERS, DUPLEX DIRECT-ACTING, CENTRIFUGAL, TURBINE PUMPS FOR EVERY SERVICE; BOILER FEED, ELEVATOR, FIRE, PRESSURE PUMPS; WATER METERS; WATER WORKS, SEWAGE AND DRAINAGE PUMPING ENGINES.



One of the N. Y. C. & H. R. R. Co. Power Plants

All WORTHINGTON CONDENSING APPARATUS, whether of the SURFACE or JET type, is designed upon the counter-current principle, and is capable of maintaining in service the highest vacuum attainable with the quantity and temperature of water for which it is designed.

The success of this apparatus has been due to its careful development along scientific engineering lines, in many of which the WORTHINGTON COMPANY was the Pioneer. All of the details of design are carefully worked out with reference to durability as well as efficiency and absolute reliability in service.

The WORTHINGTON COMPANY will be pleased to furnish preliminary estimates, drawings and advice at all times.

## *Condensing Apparatus*

# WHEELER CONDENSER AND ENGINEERING CO.

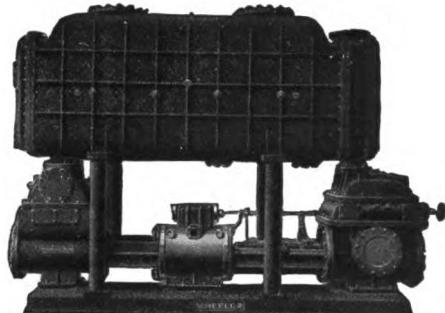
THE PIONEER AMERICAN CONDENSER BUILDERS

MAIN OFFICE AND WORKS: CARTERET, NEW JERSEY

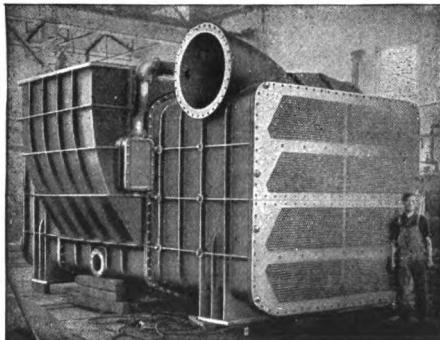
### BRANCHES

New York, Boston, Philadelphia, Chicago, St. Louis, St. Paul, Cincinnati, Pittsburgh, Dallas, Cleveland, Denver, San Francisco, Salt Lake City, Los Angeles, Seattle, Portland, Tucson, Ariz., Charlotte, New Orleans, Atlanta, London, Yokahama, Trieste, Melbourne, Paris.

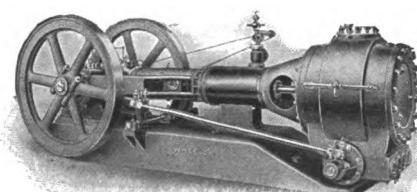
### MANUFACTURERS OF COMPLETE CONDENSING EQUIPMENTS



Wheeler Admiralty Surface Condenser mounted over  
Combined Air and Water Pumps



Wheeler Dry Tube Surface Condenser for Steam  
Turbine Work



Wheeler Rotative Dry Vacuum Pump

#### HIGH VACUUM SURFACE CONDENSERS FOR STEAM TURBINES.

For turbines of any capacity, condensing equipments operating on wet or dry system, tube surface of condenser arranged to give best distribution of steam for high efficiency and designed on the dry tube principle to give maximum rate of heat transmission. Built as base condensers for vertical turbines, also for horizontal turbines with either rectangular or cylindrical shells. For maximum temperature of condensate, Wheeler-Volt combined condensers and feed water heaters are supplied.

#### HIGH VACUUM JET CONDENSERS FOR STEAM TURBINES.

For turbines of any size to maintain vacuum of 28 inches and up. Built on the countercurrent "rain type" principle to insure maximum temperature of discharge water, and therefore, minimum quantity of water, and minimum pumping cost.

#### WHEELER-EDWARDS AIR PUMPS, FOR AIR AND CONDENSATE.

Eliminates expense of independent air and hot well pumps. No suction or bucket valves.

#### WHEELER ROTATIVE DRY VACUUM PUMP.

Will maintain a vacuum within .5" of barometer. For high vacuum jet condensers and large dry tube surface condensing equipments. Clearance effect reduced by rotative snift valve.

#### CENTRIFUGAL PUMPS FOR ALL SERVICES.

Circulating, tail water and hot well pumps for condensing work. Pumps of all sizes driven by motor, steam turbine or engine for water works, irrigation, etc.

#### FORCED DRAFT STEEL TOWERS.

Recommended for efficient cooling of water where ground space is limited, and smallest size tower must be used.

#### NATURAL DRAFT WOODEN TOWERS.

For manufacturing and industrial plants, also central stations where a supply of cooling water is not available. First cost of power low and operating cost consists of water pumping cost only. Designed for special low lift so as to reduce this cost to the minimum.

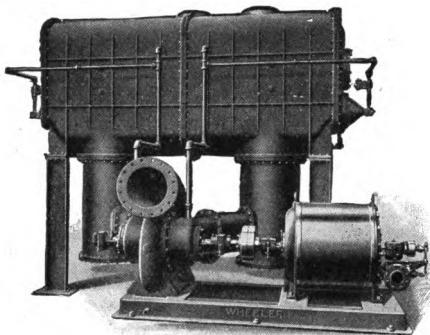
#### FEED-WATER HEATERS, ATMOSPHERIC EXHAUST RELIEF VALVES, VACUUM PANS, MULTIPLE EFFECTS, Etc.

# WHEELER CONDENSER AND ENGINEERING CO.

THE PIONEER AMERICAN CONDENSER BUILDERS



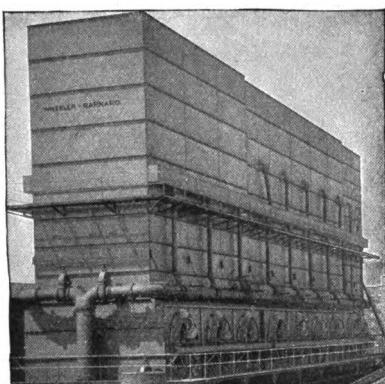
Wheeler Barometric  
Condenser



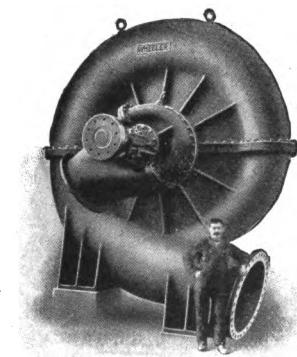
Wheeler Rectangular Jet Condenser (Counter-Current  
Rain Type) for High Vacuum Steam Turbines  
Patented



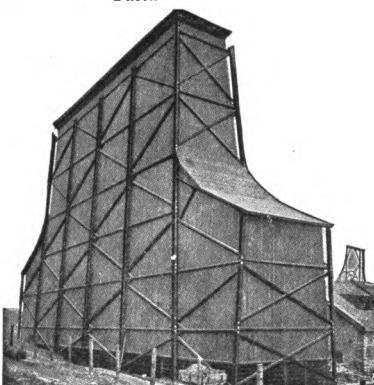
Wheeler Edwards  
Air Pump  
Patented



Wheeler-Barnard  
Forced Draft Cooling Tower  
Patented



Wheeler Centrifugal Pump



Wheeler-Balcke Natural Draft Wooden  
Cooling Tower



**ALUMINUM COMPANY OF AMERICA**  
**PITTSBURGH PENNA.**

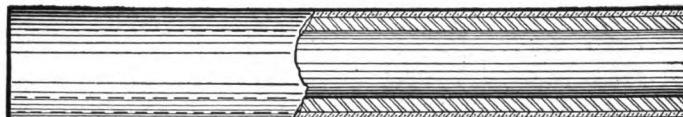
## **BRANCH OFFICES**

New York, 99 John Street  
Boston, Mass., 131 State Street  
Pittsburgh, Pa., 2344 Oliver Bldg.  
Cleveland, O., 719 Garfield Bldg.  
Detroit, Mich., 1515 Ford Building  
Chicago, Ill., Old Colony Building  
Rochester, N. Y., 406 Powers Bldg.  
Philadelphia, Pa., 320 Witherspoon Bldg.  
Washington, D. C., 514 National Metropolitan Bank Bldg.  
Toronto, Ont., Northern Aluminum Co., Ltd., 1503 Traders Bank Bldg.

Pierson, Roeding & Company, 118 New Montgomery St., San Francisco, Cal.

**ALUMINUM**  
INGOT RODS TUBE  
SHEET MOULDINGS FITTINGS  
CASTING ALLOYS BRONZE POWDER  
ELECTRICAL CONDUCTORS LITHOGRAPH PLATES

## **BIMETALLIC CONDENSER TUBES**



Bimetallic tubes, composed of a copper envelope over an aluminum lining (or vice versa), possess longer life without pitting and leaking than any other tubes when used with cooling water high in sulphuric acid and sulphates. They also stand high in the scale of heat conductivity.

## **FABRICATED ALUMINUM**

Kettles, tanks, coolers, evaporators, pipe lines and miscellaneous apparatus for chemical, soap, candle and stearic acid manufacture, also for preserving and brewery processes.

## **ALUMINUM CABLE FOR TRANSMISSION OF ELECTRICAL ENERGY**



**Joints of aluminum cable and feeders can be made easily, cheaply and satisfactorily.**

*Condenser Tubes*

# BRIDGEPORT BRASS COMPANY

96 Crescent Avenue

BRIDGEPORT, CONN.

CONDENSER TUBES OF THE HIGHEST QUALITY; "BRIDGEPORT"—BRASS AND ADMIRALTY MIXTURE; TINNED AND PLAIN. ALSO FERRULES OF ALL KINDS.



Our experience in manufacturing high grade Condenser Tubes enables us to meet the most exacting requirements. We have made a careful study of this particular class of work, and with this experience and the most approved methods at our command, "*Bridgeport*" Condenser Tubes represent quality of the highest standard.

Every tube is rigidly tested and inspected.

The severity of the requirements in modern power station service demands the highest grade of Condenser Tubes—*For Condenser Tubes of Quality specify "Bridgeport."*

Bronzes. In rod and sheet.

"Bridgeport," a special bronze. Great tensile strength and high elastic limit, for shafting, piston or plunger work. Also Manganese, Aluminum, Phosphor and Silicon Bronze.

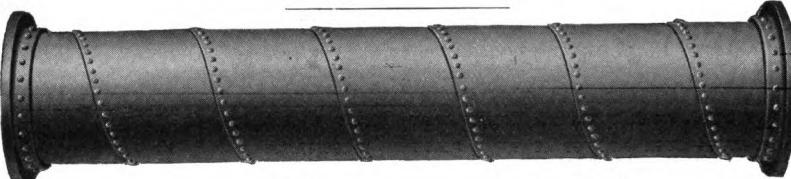
Special shapes. Drawn or stamped from Brass, Copper, Bronze and German Silver. Send sample or blueprint for estimate of price.

## ABENDROTH & ROOT MFG. CO.

NEWBURGH, N. Y.

50 CHURCH STREET, NEW YORK

ROOT SPIRAL-RIVETED PIPE, WATER TUBE BOILERS, EXHAUST  
HEADS, HYDRAULIC MINING EQUIPMENT, GENERAL  
FOUNDRY AND MACHINE WORK, ETC.



ROOT SPIRAL RIVETED PIPE

THE LONG LIFE OF ROOT SPIRAL RIVETED PIPE is secured, not by weight of metal, but by the use of special rust resisting coatings applied in such a way as to permeate the seams and pores of the metal. There are at the present time in successful operation waterworks systems equipped by us over twenty-five years ago, using many miles of Root Spiral Riveted Pipe under high pressure. On several occasions, where alterations have made it necessary to uncover this piping, it has been inspected and found to be in apparently as good condition as when originally installed.

ROOT SPIRAL RIVETED PIPE is fully two-thirds stronger and more rigid than Straight Seam Riveted Pipe of equal weight. This great rigidity is owing to the entire absence of cross seams tending to weaken the pipe. There is but one continuous helical seam from one end of the length to the other, and this forms a stiffening rib of great value which is not exposed to wear and which preserves the rigidity of the pipe even after the general thickness of the metal has been considerably reduced by inside frictional wear, as in dredging, where sand and other abrasive material is passed through the pipe. There are no cross-seams, the strip of metal extending unbroken through the entire length.

Experiment has proved the helical seam to be stronger even than the sheet, and where Root Spiral Riveted Pipe has been tested to destruction, fracture has always occurred away from the seam and toward the center of the strip, proving the value of this special form of construction.

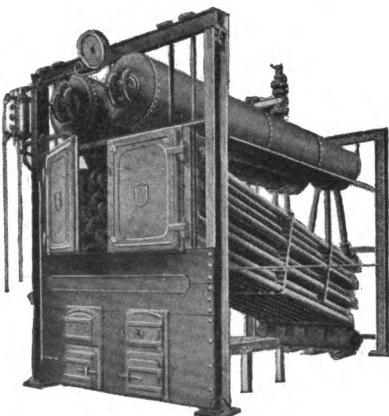
THE ABSOLUTE PROTECTION AGAINST DECAY which is given by our special coatings, Asphalting or Galvanizing, and the exceptional strength, rigidity and tightness, made possible by the helical seam in Root Spiral Riveted Pipe, enable us to supply a lighter pipe for any given service than is possible with any other form of construction.

This pipe is made either with flanges attached, with plain ends and bolted joints, or with slip joints. The flanged joint is generally used on Galvanized Pipe for conveying exhaust steam, compressed air, etc. For Asphalted and also for Galvanized Pipe when used for water conveying, we recommend our Root Bolted Joint, as we believe this is the best, easiest applied, tightest and strongest joint for a high pressure service which it is possible to devise. For sizes 12" and over it is considerably cheaper than flanges, the percentage of saving increasing rapidly with the size. This joint is ideal for export use, as it admits of nesting several sizes of plain end pipe, the joints being knocked down and crated separately, securing much lower ocean freights. The joint form is also flexible to a certain extent and makes easy the laying of pipe lines over rolling ground or in shifting soil.

### ROOT WATER TUBE BOILERS

The Root Water Tube Boiler, which is made in units from 10 H.P. to 450 H.P., embodies to the highest degree fuel economy, easy steaming qualities, large capacity for overload, safety, and low cost of repairs. All parts subject to wear are interchangeable, and boiler when so ordered can be made sectional so as to permit of mule back transportation.

Catalogs on request.



## THE GREEN FUEL ECONOMIZER CO.

MATTEAWAN, N. Y.

New York City      Boston      Chicago      Atlanta      San Francisco  
Los Angeles      Seattle      Salt Lake City      Montreal

**FUEL ECONOMIZERS** for recovering waste heat from boiler furnaces, kilns, soaking pits, metallurgical furnaces, core ovens, gas engines, etc., to heat water for boiler feeding and other purposes.

**WASTE AIR HEATERS**, similar to the Economizer and utilizing heat from the same sources to heat air for the heating of buildings, or for drying purposes, regenerative furnaces, etc.

**FANS, BLOWERS** and **EXHAUSTERS** for ventilating and for moving air for all purposes.

**ENGINES**, horizontal and vertical, throttling or automatic, for driving fans.

**POSITIVE FLOW HOT BLAST HEATERS**, for live or exhaust steam or hot water.

**DRYING EQUIPMENTS** for all kinds of material.

**HEATING AND VENTILATING EQUIPMENTS**.

**MECHANICAL DRAFT INSTALLATIONS**.

**GREEN'S FUEL ECONOMIZER** is the embodiment of the "counter-current" principle in steam boiler operation. 1 sq. ft. of economizer surface will take the place of 2 sq. ft. of boiler surface otherwise required, since by reason of the lower temperature of the economizer contents and consequent greater "temperature head" it is able to absorb heat more rapidly from the chimney gases.

By reducing the flue temperature from 600° F. to 300° F., and by heating the feed water from 100° F. to 250° F., it will save 15% of fuel and pay for itself within 2 years.

Economizer heating surface increases the steaming capacity, in the ratio of the fuel saved.

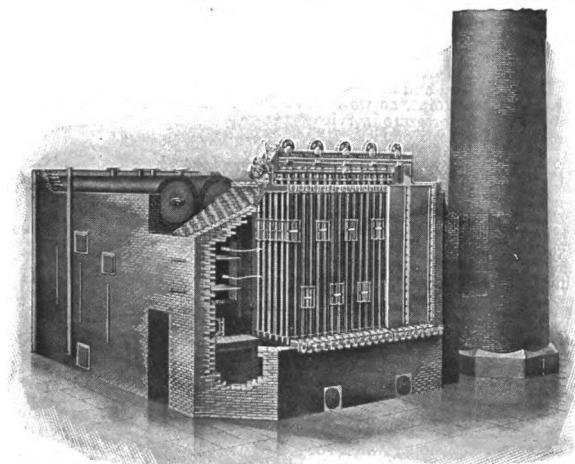
The economizer contains about 1 hour's supply of hot water and provides heat storage to assist in carrying "peaks" or overloads.

Higher steam pressures mean higher flue temperatures and greater need of the economizer.

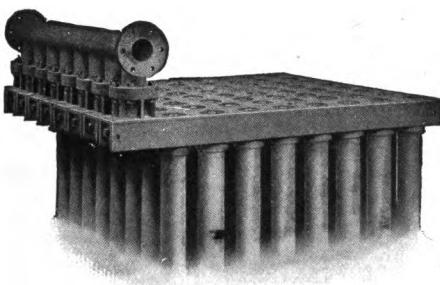
More efficient auxiliaries provide less exhaust for heating feed water and render the economizer more essential.

Higher vacuum condensers deliver colder condensate, increasing profit from economizer.

By reducing flue gases to low temperature, in economizer, harmful effects of excess air in furnace are cancelled. Economizers are profitably employed for heating water for industrial uses in paper mills, laundries, salt works, gas works, etc.



Green's Economizer Installed



Group of Green's Fuel Economizer Sections, Showing the New Extended Top Header with Flexible Connection to Branch Pipe

ers, 5 ft. 5 ins. with one damper, 6 ft. 2 ins. with two; areas between pipes, 29.10 and 36.35 square feet respectively.

Eight pipe sections: 6 ft. inside walls without side dampers, 6 ft. 9 ins. with one damper, 7 ft. 6 ins. with two; areas between pipes, 27.00, 34.25 and 41.5 square feet respectively.

Ten pipe sections: 7 ft. 4 ins. inside walls without side dampers, 8 ft. 1 in. with one damper, 8 ft. 10 ins. with two; areas between pipes, 32.25, 39.50 and 46.75 square feet respectively.

Twelve pipe sections: 8 ft. 8 ins. inside walls without side dampers, 9 ft. 6 ins. with one damper, 10 ft. 3 ins. with two; areas between pipes, 39.25, 44.75 and 51.50 square feet respectively.

Green's Junior Economizer in special sizes for narrow spaces.

The pipes are of a special grade of iron, cast in vertical dry sand molds and tested to 500 lb. pressure per square inch before forming into sections; 350 lb. after forming, and twice the working pressure when installed.

The connections between the top and bottom headers and the branch pipes are entirely outside the economizer chamber and are easily made and unmade by the ordinary mechanic. They have sufficient flexibility to take care of unequal expansion due to changes of temperature and distortion due to slight unequal settlement of foundations.

The top headers are planed on the sides, making a gas-tight joint which renders other covering unnecessary. Our Ovoid Bottom Header is specially designed to permit the soot to fall through. Access to every part of the economizer is easily accomplished by means of Green's Sectional Covering.

Green's Economizer is arranged to secure the greatest heat absorption while impeding the draft the least.

Green's Economizer has been perfected by 60 years' use.

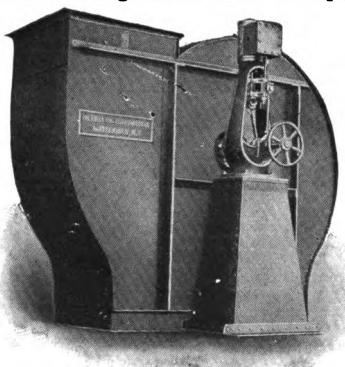
Green's Economizers are used in the largest and most economical steam plants throughout the world. Many have been in service for more than 30 years continuously.

### GREEN'S STEEL PLATE FANS

for heating and ventilating, mechanical draft, conveying materials, etc.

Wheels and housings are extra heavy. Wheels have angle iron fastenings for the floats and are strengthened by angle iron rings in the larger sizes.

The wheels are corrected for running balance, and bearings are ring-oiled and adjustable.



Engine Driven Fan

Send for special publications on (1) Fuel Economizers, (2) Fans and Blowers, (3) Heating and Ventilating Buildings, (4) Mechanical Draft, (5) Drying, (6) Waste Heat Air Heaters, (7) Planing Mill Exhausters, (8) Heat Saving in Water Gas Plants, Breweries, Cement Mills, Paper Mills, etc.

357

## POWER SPECIALTY COMPANY

111 BROADWAY, NEW YORK, N. Y.

Boston Philadelphia Chicago Pittsburg Birmingham San Francisco

**FOSTER SUPERHEATERS; DUVAL METALLIC PACKING; SUPERHEATED STEAM  
BRONZE GASKETS, HEENAN MUNICIPAL REFUSE DESTRUCTORS.**

### FOSTER SUPERHEATERS

The Foster Superheater is made in four general types, as follows:  
Attached Type for Superheating up to 200 deg. Fahr.  
Separately-Fired Type for any variety of fuel and any range of superheat up to 1200 deg. Fahr.  
Waste-Heat Type for steel and fabric mills or marine practice.  
Portable Type for heating steam or air with oil, coal or gas fires.



Great strength and durability, combined with extreme simplicity and adaptability to any type of boiler.

#### Structural Features

All parts under pressure are of steel, thus giving maximum strength.  
All parts exposed to gases of combustion are cast iron.

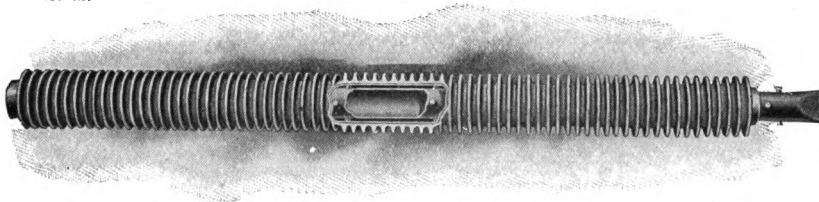
The elements are usually U bends of seamless tubing expanded into steel manifolds. Where U bend construction cannot be used, straight elements are expanded into individual steel return headers at free ends.

Opposite the end of each element a handhole fitted with steel plug and metallic gasket is provided to give free access to every part of the interior for inspection or cleaning. All holes into which tubes are expanded or hand-hole plugs fitted are carefully reamed to gage.



**2" Handhole plug, gasket, cap and nut used in construction  
of Foster Superheaters**

The elements consist of bodies of seamless cold-drawn steel tubing, to the outside of which is snugly fitted a heat-resisting cast-iron covering with deep external annular corrugations for the protection of the bodies against the action of the heated gases. These annular gill flanges form an extension surface for the absorption of heat from the hot gases, which heat is passed to the steam contained in the tubes. They provide a section of great ultimate strength with absolute freedom from internal strains. They also provide a mass of metal which acts as a reservoir for heat to be imparted to the steam regularly and prevent fluctuations in the temperatures of the hot gases from producing corresponding fluctuations in the superheating of the steam. An inner tube or core is fitted to each straight heating tube, the core being of cylindrical form closed at each end and supported concentrically with the tube by frequently spaced steel knobs. This thin annular conduit for passage of the steam, while receiving the superheat, adds to the efficiency of the heating surface, insures complete distribution of steam through all parts of superheater and the impossibility of passing water through the elements.



### SUPERHEATED STEAM

Superheating steam has become a modern necessity; saving fuel, increasing capacity and duty of engines and turbines, insuring longer life and greater economies in boiler, steam pipe and condenser.

For steam turbines, reciprocating engines, generating units, feed pumps and auxiliaries, any superheat up to 500 deg. Fahr. will be found satisfactory. For industrial uses, temperatures up to 1200 deg. Fahr. are made possible by the Foster construction.



Cross section of return bend element and connecting headers used in the construction of Foster Superheaters

### DUVAL METALLIC PACKING

is extensively used for superheated and saturated steam, also for steel or iron plungers where working in water or oil, in pumps or accumulators, for heavy pressures from 500 to 2500 pounds per square inch of pressure. No special stuffing-box is required. The packing is flexible, made of fine quality wire plaited in square form and is easily cut with wood chisel. It is adopted in the French, British and American Navies.

### SUPERHEATED STEAM BRONZE GASKETS

give excellent satisfaction for flanged joints carrying superheated steam. The metal has elastic properties and the corrugations are even, with sharp ridges.

## C. A. DUNHAM COMPANY

MARSHALLTOWN, IOWA

NEW YORK: NO. 1. MADISON AVE.

CHICAGO: 343 S. DEARBORN ST.

SAN FRANCISCO: 637 MONADNOCK BLDG.

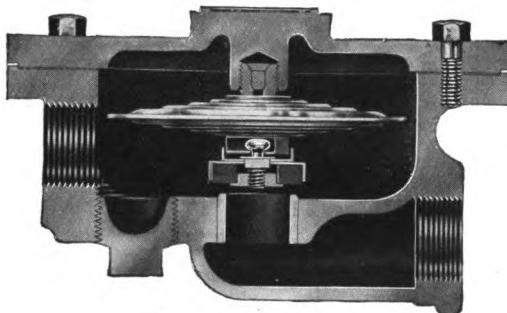
MANUFACTURERS OF THE DUNHAM RADIATOR TRAP, THE DUNHAM BLAST TRAP,  
THE DUNHAM AIR VALVE AND THE DUNHAM VACUUM AND VACUO VAPOR  
SYSTEMS OF HEATING



The Dunham Radiator Trap

"It lasts and while lasting works"

Made in four patterns—Right hand, left hand, straight way and angle.  
Size connections— $\frac{1}{2}$  inch pipe. Capacity—350 sq. ft. direct radiation.  
Maximum steam pressure—10 lbs. Wt.— $2\frac{1}{2}$  lbs.



The Dunham Blast Trap

### THE DUNHAM RADIATOR TRAP

for use in connection with the Dunham Vacuum and Dunham Vacuo Vapor Systems of Steam Heating. It will positively allow for the complete discharge of water and air from the radiator to which it is attached without loss of steam. Constructed of phosphor bronze.

### THE DUNHAM BLAST TRAP

for use in draining blast coils in vacuum or other steam heating systems. Also for use on large direct radiating units where the Dunham Radiator Trap is too small. Positively opens for water and air and closes for steam. Body made of cast iron.

Made in one pattern only—straight way.

Size	Capacity	Connection	Wt.
$\frac{3}{4}$ "	1500 sq. ft. direct radiation	$\frac{3}{4}$ " pipe	13 lbs
1"	3000	1" pipe	21 "

Care must be taken in reducing blast surface to equivalent direct by multiplying by a factor ranging from 3 to 9, depending upon the temperature, velocity and volume of air being forced over the coils.

### THE DUNHAM AIR VALVE

This valve is made for use in revamping both old and new air-line jobs. It is built upon the same principle as the Dunham Radiator Trap. Is nickel plated all over and has union nut and nipple. Made for  $\frac{1}{2}$  inch pipe connection. Architects and engineers can specify this valve with the positive assurance that it will give service without necessitating the attention that is required to keep so many other air line valves in working order.

### DUNHAM VACUO VAPOR SYSTEM

is simply a low-pressure system of heating that works upon pressure, vapor, and vacuum, without necessitating the use of a vacuum pump. It is particularly applicable to residence, apartment house, and church heating where low pressure (below 5 lbs.) boilers are used.

*Complete information, catalog and prices will be sent on application.*

The Dunham System is installed in such buildings as the Woolworth Bldg., N. Y.; 80 Maiden Lane Bldg., N. Y.; Insurance Exchange Bldg., Chicago; Sherman Hotel, Chicago, and hundreds of other buildings all over the country.

# THE FOSKETT & BISHOP CO.

NEW HAVEN, CONN.

ENGINEERS AND CONTRACTORS, POWER PLANTS, GRINNEL AUTOMATIC SPRINKLERS AND APPLIANCES, HEATING, PLUMBING AND GAS FITTING, STEAM TRAPS, STEAM SPECIALTIES

## THE FOSKETT & BISHOP PATENT IMPROVED STEAM TRAPS

**DESCRIPTION.**—The valve comprises the seat which screws into the head, and a disk which is attached to the seat by a hinge and has composition packing set in a slot made in said disk.

G is a heavy copper ball or float tested at a pressure of 300 pounds per square inch, attached by a brass rod to the disk of said valve. The outlet in head is where the water is discharged from the trap; D is the steam and water inlet; C is a copper strainer or basket; H is a plug, by unscrewing which access is had to the strainer for cleaning it; F is an outlet for drawing off all the water from the trap if desired, or discharging water of condensation when exhaust steam is used.

**OPERATION.**—When steam is let on to radiators or coils to which the trap is attached, the water flows before the steam into the shell until the float G is raised, which lifts the disk from the seat of the valve and the water is discharged through outlet in head. When enough water is thus discharged to allow float G to fall, the valve is closed and the water again accumulates preparatory to another discharge; so it continues to work, never failing to discharge the water if enough is present to raise the float.

**STANDARD SERVICE.**—These Traps are recommended for any service requiring the removal of water of condensation without escape of the steam behind it.

For draining the condensation from steam pipes, coils, and apparatus employed in steam heating, steam kettles, vacuum pans, mash kettles, steam engine supply pipes and separators, evaporating pans, steam jackets on engines and pumps, ice machine stills, etc.

**PRESSURE CONDITIONS.**—In ordering it is important that the steam pressure under which they are to be used should be stated.

The Standard Trap is designed for an extreme pressure of 100 pounds, but where this pressure is to be constant, or likely at any time to exceed this limit, it is better to use the extra heavy type.

Where the Trap is to be used under extreme low pressure conditions,—1 to 20 lbs.,—the duty should be specifically stated, in order that a valve of proper area may be supplied. For this duty the Standard Trap is furnished, but with a larger opening than is used for the ordinary service, which is between 20 and 100 lbs.

**TRAP CONNECTIONS.**—In selecting a Steam Trap for a given duty it should be borne in mind that the size of the inlet in no way governs the capacity of the Trap, therefore the pipe entering Trap at "inlet" may be arranged to suit connections without affecting the operation of the Trap—care being taken that a Trap of proper capacity is selected for the work.

Should the duty exceed the capacity of the largest Trap listed, two or more Traps may be readily placed side by side, connected to a common horizontal header and operated as one Trap, in order to obtain the necessary trappage capacity.

## SIZES, DIMENSIONS, CAPACITIES

Number of Trap.....	0	1	2	3
Size of inlet connection.....	1 in.	1½ in.	2 in.	2 in.
Size of outlet connection.....	½ in.	½ in.	¾ in.	1¼ in.
Maximum discharge lbs. water per minute.....	2	4	8	20
Greatest number of lineal feet of 1 inch pipe surface to which trap should be applied.....	800	1500	4000	10000

## KIELEY AND MUELLER

34 WEST 13TH ST.

NEW YORK CITY

MANUFACTURERS OF A COMPLETE LINE OF HIGH GRADE STEAM, WATER AND AIR SPECIALTIES FOR MODERN HEATING, POWER AND PLUMBING INSTALLATIONS.

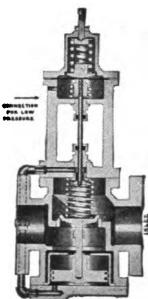
### HIGH PRESSURE PILOT REDUCING VALVE

Suitable for reducing steam pressures from the initial or high pressure carried, down to any pressure on the reduced side above 5 pounds that may be desired.

Made especially for reducing extreme high pressures; tested to a pressure of 400 pounds; will positively limit the reduced pressure to whatever it is set at; the only valve of this type in which the metal diaphragm can be renewed without shutting steam off the line.

Guaranteed to deliver an absolutely steady reduced pressure, even though there is a variation of initial pressure.

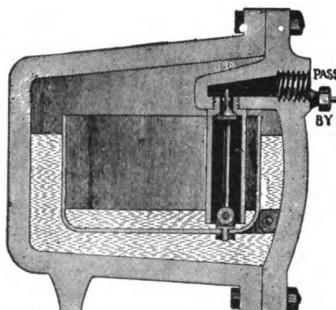
The sectional cut shows this valve is of the single seat type, in consequence of which difference in the expansion of the metals of which it is constructed does not prevent it from closing absolutely tight, under the highest pressures.



### KIELEY STEAM TRAPS

The few wearing parts are of standard gauge and interchangeable, obtained at a minimum of cost, easily and readily placed in position without breaking a single pipe connection. By-pass arrangements a feature and part of each trap, and many other desirable features, recognized by all familiar with these goods.

Style A—low-pressure, for pressures from 1 to 30 pounds per sq. inch. Style B—high-pressure, for pressures from 30 to 125 pounds per sq. inch. Style C—extra heavy, for pressures ranging from 125 to 250 pounds per sq. inch.



Standard Style  
Extra Heavy

### OTHER PRODUCTS

Reducing Valves for steam, water, air, etc.

Back Pressure Valves for all purposes.

Atmospheric Relief Valves for all purposes.

Steam Traps for all purposes.

Damper Regulators of various kinds.

Hot Water Temperature Controllers.

Steam and Water Separators.

Oil and Grease Extractors (especially our 1906 type).

Pump Regulators.

Water Pressure Regulators.

Water Feeders.

Return Steam Traps.

Feed Water Regulators.

Grease and Oil Traps.

Water Arches.

Emergency Valves.

Low Water Alarms.

High and Low Water Alarms.

Strainer Connections of various kinds.

Drip Tank Controllers.

Float Valves.

Tank Pump Controllers.

Pump Governors and Receivers.

Combination Muffler and Grease Extractor Tank, Receiver, Pump Governor, Pump and Feed Water Heater.

Grease Extractor and Purifier

Waste Heat Utilizers.

Feed Water Heater, etc.

NOTICE:—Trade Mark "KILEMUL" appears on all our specialties, and are known by that name. Kindly order or specify accordingly.

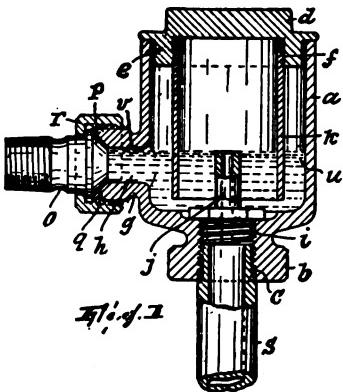
COMPLETE CATALOGUE SENT ON REQUEST.

# AUGUSTUS MOWELL

249 GRAHAM AVE.

PATERSON, N. J.

## MO WELL'S AUTOMATIC RELIEF VALVE FOR STEAM HEATING SYSTEMS



### MO WELL'S AUTOMATIC RELIEF VALVE

The adjoining cut is self-explanatory. This valve has no moving parts; nothing to get out of order. Access to the valve is readily had for the purpose of cleaning, removing sediment, etc.

It is a perfect Valve for use where exhaust or other low pressure steam is used in the heating systems.

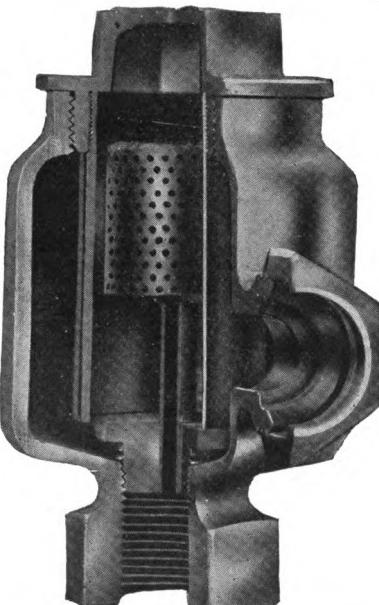
The construction is very simple: Chamber *a* has a nipple *j* extending up from the bottom and forming the outlet to pipe *s*; the top of this nipple is approximately in the same level as the top of inlet *v*. In chamber *a* is a depending cylinder, which projects far enough down to form with nipple *j* a water seal; this cylinder has a

small vent *k'*. When steam enters the system, water of condensation first passes through the radiator and finds its way out through chamber *a*, via nipple *j*. This water is followed by air, which, being prevented by the water seal from escaping directly through nipple *j*, escapes indirectly through vent *k'*. Finally, the steam following the air, attempts to escape through *k*, but this at once stops because a globule of condensed steam forms and obstructs *k'*.

It will be clear at once that whereas water and air are immediately withdrawn from the system, there is no appreciable waste of steam; in consequence of the immediate removal of the water and air, followed directly by steam filling each radiator, the radiators heat up immediately the system is put into operation.

### USERS OF MO WELL'S AUTOMATIC RELIEF VALVE

Meisch Mfg. Co., Mills: Paterson, N. J.  
I. A. Hall, " " "  
Henry Doherty, " Lakeview, Paterson, N. J.  
P. S. Van Kirk Co., Mills: Paterson, N. J.  
Pioneer Realty Co., " " "  
Ralph Rosenheim, " " "  
Garfield Worsted Spinning Mills, Garfield, N. J.  
Atchison Harding, Mills, Passaic, N. J.  
R. N. Bassett Co., Shelton, Mass.  
Ira White Co., Bloomfield, N. J.  
F. H. Levey Co., Brooklyn, N. Y.



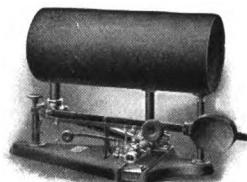
Sectional view of valve showing interior parts as in use, except that screen has been fastened up to show water seal.

## MOREHEAD MFG. CO.

DETROIT, MICH.

TILTING STEAM TRAPS, RETURN, NON-RETURN, VACUUM AND CONDENSER TYPES, FOR DRAINING HIGH OR LOW PRESSURE AND VACUUM HEATING SYSTEMS OF WATER OF CONDENSATION, and where desired, returning the condensation to the boiler as feed water. There is a Morehead Steam Trap to meet every condition arising in a steam or gas plant.

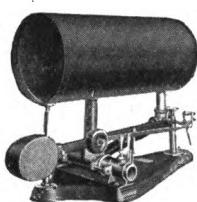
### RETURN STEAM TRAP



Morehead Return Steam Trap

The Return Steam Trap removes water of condensation from heating, drying and cooking apparatus and returns the condensation direct to the boilers regardless of any difference in pressure on the apparatus drained and the boiler or whether the apparatus is located above or below the water line. It is admirably adapted for use as a lift pump and for feeding boilers from open or closed heaters. It handles perfectly, water at any temperature.

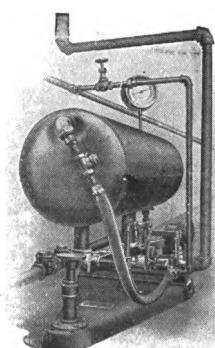
### NON-RETURN TRAP



Morehead Non-Return Steam Trap

This type of Morehead Steam Trap is especially adapted to the removal of condensation from high or low pressure steam mains, dryers, heaters, etc., and delivering the water to an open tank, hot well or feed water heater. This trap has a removable seat and disc in the valve. It discharges from low point, insuring an effective *water seal* at all times. It is guaranteed for 200 lbs. working pressure.

### VACUUM TRAP



Morehead Condenser Trap

This is a cut of an actual installation. The check valves and gage shown in cut are only furnished as extras.

The Vacuum Trap removes automatically all condensation from exhaust lines and oil separators operating under a vacuum without breaking or impairing that vacuum. It delivers the water of condensation to any desired point above or below the location of the trap and is guaranteed not to affect the vacuum in any way.

### CONDENSER TRAP

The Condenser Trap is a combination of the features of a Morehead Automatic Return Trap and the Jet or Spray Condenser. It is especially adapted to service on exhaust steam and reduced pressure heating, cooking and drying apparatus. The *positive vacuum* formed in the tank of the trap removes rapidly all condensation in the system, accelerates the travel of the steam and reduces the back pressure on the engine.

**MOREHEAD TILTING NON-RETURN STEAM TRAPS**  
Sizes and Capacities

No.	Inlet Inches	Outlet Inches	Capacity in Water Discharged per Hour	Drainage Capacity in 1 inch Pipe Lineal	Capacity Square Feet Direct Radiation	Capacity Lineal Feet Hot Blast Heater	Weight
21	1	1	200 gal.	12000 ft.	3000	1300	100
22	1½	1½	400 "	25000 "	5200	2400	175
23	1½	1½	600 "	40000 "	12000	5200	250
24	2	2	720 "	60000 "	21000	9000	275
25	2½	2½	900 "	90000 "	33000	16000	350
26	3	3	1300 "	140000 "	50000	25000	450

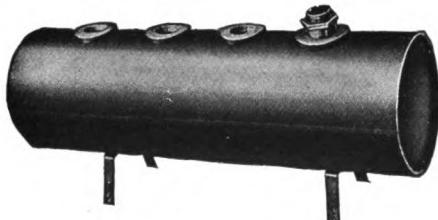
**MOREHEAD TILTING RETURN AND VACUUM STEAM TRAPS**  
Sizes and Capacities

No.	Size of Drum	Size of Inlet and Outlet Connec- tions Inches	Size of Steam Pipe Connec- tions Inches	Capacity of Water in Lbs. per Hour	Drainage Capacity in feet of 1 inch Pipe Lineal	Capacity Square Feet Direct Radiation	Capacity Lineal Feet Hot Blast Heater	Weight
1	10 x 24	1	1	1050	5000	2300	1000	100
2	12 x 30	1½	1	1850	9000	4000	1800	175
3	14 x 36	1½	1½	4000	20000	9000	4000	250
4	16 x 40	2	1½	6000	35000	16000	7000	275
5	18 x 42	2½	2	11000	50000	25000	12000	350
6	18 x 42	3	2	15000	75000	40000	18000	400

The above capacities are figured on a basis of 50 pounds pressure to the square inch. The above drainage capacity in inch pipe is based on ordinary radiating conditions. For lumber kilns, greenhouses and moist goods, divide by two. For laundries, brick dryers and wet goods, divide by three. For fan stacks and blowers, divide by five.

NOTE—3 feet of 1 inch pipe equals one square foot of surface. 2.3 feet of 1½ inch pipe equals one square foot of surface. 2 feet of 2 inch pipe equals one square foot of surface. 1.61 feet of two inch pipe equals one square foot of surface.

**MOREHEAD RECEIVERS**



No.	Length Inches	Height Inches	Dia- meter Inches
1	30	16	10
2	40	20	12

No. 1 Receiver has capacity for Traps Nos. 1 and 2. No. 2 Receiver has capacity for Traps Nos. 3, 4, 5 and 6.

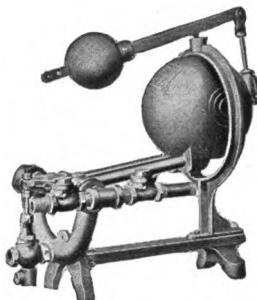
We will be glad to advise regarding the installation of traps to meet the conditions of your steam system.

**NASHUA MACHINE COMPANY**  
NASHUA, N. H. BOSTON, MASS.

## NEW BUNDY STEAM TRAPS

Manufactured under Littlefield Patents

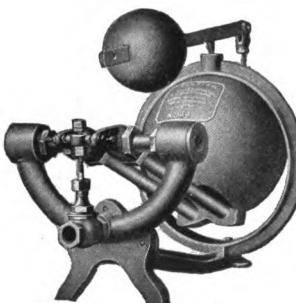
**120 SERIES, NEW BUNDY RETURN TRAP**



Used to automatically feed boilers, to return condensation to boilers, to relieve steam mains, heating coils, etc., to protect property, and to increase the efficiency of steam using apparatus.

**Works up to 175 lbs. pressure.**

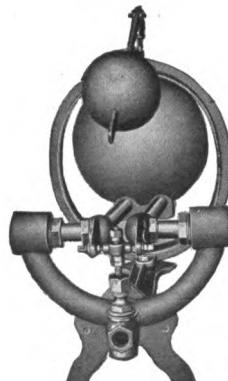
**30 SERIES, NEW BUNDY SEPARATING OR TANK TRAP**



New Bundy Separating or Tank Traps are designed to separate water from steam and are used for draining separators, headers, cylinder jackets, cooking apparatus, steam coils, etc. Discharging direct to the atmosphere or into hot well, heater, or tank.

Works up to 140 lbs. pressure.

90 SERIES, NEW BUNDY SEPARATING OR TANK TRAP



In this series we produce a machine of superlative quality. No amount of expense has been spared in our efforts to place this trap at the head of the class as a high pressure tank trap and one that can be offered to the purchaser under a positive guarantee covering both strength and efficiency and the performance of work under conditions of the hardest possible kind.

Works up to 250 lbs. pressure.

We also manufacture Vacuum Traps and Lifting Pump Traps

## NASHUA MACHINE COMPANY

### 120 SERIES, NEW BUNDY RETURN STEAM TRAPS

No.	Pipe Connections		Lbs. of Water Delivered to Boiler per hr., based on 60 Operations, Normal Capacity	Drainage Capacity in Feet of 1 in. Pipe	Shipping Weight
	Water Inlet and Outlet, Inches	Steam Inlet, Inches			
120	$\frac{3}{4}$	$\frac{3}{4}$	800	4,500	160
121	1	1	1,380	6,000	200
122	$1\frac{1}{4}$	$1\frac{1}{4}$	2,100	10,000	290
123	$1\frac{1}{2}$	$1\frac{1}{2}$	2,520	20,000	353
124	2	$1\frac{1}{2}$	4,080	40,000	544
125	$2\frac{1}{2}$	$1\frac{1}{2}$	8,520	56,000	973
126	3	2	15,000	75,000	1,412
128	4	2	42,000	100,000	3,200

### 30 SERIES, NEW BUNDY SEPARATING OR TANK TRAP

No.	Pipe Connections		Capacity in Lbs. of Water Discharged per Hour at 50 Lbs. Pressure	1-inch Pipe Drained Lineal Feet	Shipping Weight
	Inlet, Inches	Outlet, Inches			
31	$\frac{3}{8}$	$\frac{3}{8}$	2,520	3,500	107
32	$\frac{1}{2}$	$\frac{1}{2}$	3,540	7,500	133
33	$\frac{1}{2}$	$\frac{1}{2}$	5,460	15,000	192
34	$1\frac{1}{4}$	1	9,120	25,000	240
35	$1\frac{1}{4}$	$1\frac{1}{4}$	13,200	32,000	292
36	$1\frac{1}{2}$	$1\frac{1}{2}$	16,500	40,000	350
37	2	2	27,240	60,000	587
38	$2\frac{1}{2}$	$2\frac{1}{2}$	39,600	90,000	905
39	3	3	49,500	120,000	1,475

### 90 SERIES, NEW BUNDY SEPARATING OR TANK TRAP

No.	Pipe Connections		Capacity in Lbs. of Water Discharged per Hour at 150 Lbs. Pressure	Shipping Weight
	Inlet, Inches	Outlet, Inches		
91	$\frac{3}{8}$	$\frac{3}{8}$	3,720	128
92	$\frac{1}{2}$	$\frac{1}{2}$	8,100	151
93	$\frac{1}{2}$	$\frac{1}{2}$	14,100	235
94	1	1	24,600	269
95	$1\frac{1}{4}$	$1\frac{1}{4}$	36,800	362

The 30 series Separating or Tank Trap will work under any pressure up to 140 lbs., and the above capacities are based on what they will do under 50 lbs. pressure, with a condensation ratio of 6 to 8 oz. per lineal foot per hour. The 90 series will work up to 250 lbs. and their capacities are calculated on 150 lbs. The quantity of water that may be handled by these traps will vary directly with the given capacities, according as the pressure may increase or decrease.

### BUNDY TRAP RECEIVERS

No.	Length	Height	Diameter	No. of Inlets	Size of Inlets	Size of Outlets	Size of Blow Off
1	33 in.	10 in.	$7\frac{1}{2}$ in.	4	1 in.	1 in.	1 in.
2	33 "	11 "	$8\frac{1}{2}$ "	4	$1\frac{1}{4}$ "	$1\frac{1}{4}$ "	1 "
3	33 "	12 "	$9\frac{1}{2}$ "	4	$1\frac{1}{4}$ "	$1\frac{1}{2}$ "	1 "
4	33 "	13 "	$10\frac{1}{2}$ "	4	2 "	2 "	1 "
5	41 "	15 "	$12\frac{1}{2}$ "	4	$2\frac{1}{2}$ "	$2\frac{1}{2}$ "	1 "
6	42 "	18 "	15 "	4	3 "	3 "	1 "

# POTTER SEPARATOR CO.

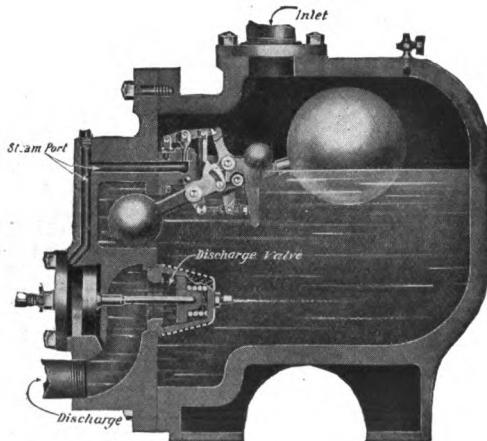
NEW YORK

## WYOMING ELIMINATORS AND STEAM TRAPS

Manufactured by W. H. Nicholson & Co., Wilkes-Barre, Pa.

The purpose of a Steam Trap is to discharge water, and the price and efficiency of any trap is governed by its discharging capacity. When buying a trap the size of inlet and outlet connections are of little consequence, but ascertain the area of the discharge-valve opening. The discharge-valve openings on Wyoming Eliminators and Steam Traps range between 1" and 4" in diameter—hence the ability of these traps to discharge large quantities of water.

The Wyoming Eliminator, a combination steam separator of first-class design and Piston Operated Trap, both separates and discharges all moisture from the steam. It is an absolutely reliable machine for arresting "slugs" of water and discharging them at the proper moment. It is made in all sizes from  $2\frac{1}{2}$ " to 16", and in Horizontal, Vertical, or Angle type.



The Wyoming Piston Operated Trap is designed especially for the purpose of taking care of large quantities of condensation, such as draining Receiver Separators, long steam lines, etc., and is guaranteed in every respect.

### DIMENSIONS OF "THE WYOMING" PISTON OPERATED STEAM TRAP

No.	Inlet	Outlet	Discharge Valve	Water discharged per hour in Gals.	Weight.
1	1 $\frac{1}{4}$ "	1"	1"	2400	132 lbs.
2	2"	1 $\frac{1}{2}$ "	1 $\frac{1}{2}$ "	4200	280 "
3	2 $\frac{1}{2}$ "	2"	2"	6500	325 "
4	3 $\frac{1}{2}$ "	3"	3"	11520	340 "
5	4 $\frac{1}{2}$ "	4"	4"	21000	700 "

NOTE.—Capacity of discharge based on 100 lbs. pressure.

# AMERICAN INJECTOR COMPANY

DETROIT, MICHIGAN

(“U. S.”) AUTOMATIC AND (“WORLD”) POSITIVE INJECTORS, “AMERICAN” EJECTORS, JET PUMPS, “GEYSER” DRIVE WELL JET PUMPS, TANK FILLERS, FIRE PLUGS, FUSIBLE PLUGS, STRAINERS, GREASE, OIL AND PRIMING CUPS, PLAIN AND SIGHT FEED LUBRICATORS, AIR AND GAUGE COCKS, WATER GAUGES, “NOISELESS” WATER HEATERS.

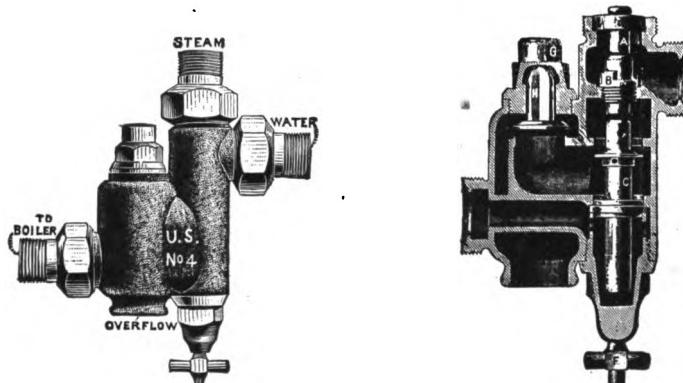
## U. S. AUTOMATIC INJECTORS

Prices and full detailed information upon request

Give 100% Efficiency. Save Time, Power, Money.

Easy to Operate. Have Wide Range. Absolutely Automatic.  
Never “Break” through jarring. Backed by an Absolute Guarantee.

Study the construction. Note the Disc Valve on the Delivery Tube, the Overflow Valve and the Drip-Cock.



“The Engineer’s Choice”

Every article we manufacture is characterized by exacting care and attention to every detail. Each device is tested beyond any possible requirement before it leaves our plant and is sold with an Iron-clad Guarantee of satisfactory service.

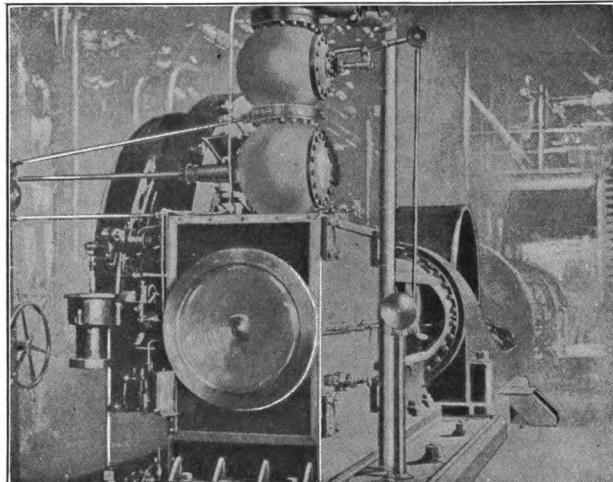
We refund the purchase price if not exactly as claimed—and we do it cheerfully.

Send for “The Engineers Red Book” and Catalog “L,” with full details about U. S. Automatic Injectors, and a fund of other information which the Engineer will find of practical value in the operation of the power plant. You will receive them by return mail.

# THE STRONG, CARLISLE & HAMMOND CO. CLEVELAND, OHIO

STRONG ENGINE STOP, STRONG STEAM TRAP, STRONG SEPARATORS FOR OIL OR STEAM, STRONG VACUUM TRAPS, STRONG REDUCING VALVES, STRONG PUMP GOVERNOR AND PRESSURE REGULATOR.

## THE STRONG ENGINE STOP



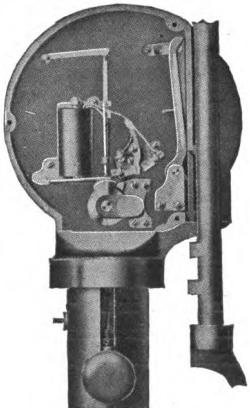
One of ten engines in large mill equipped with this apparatus

The Strong Engine Stop is composed of three main parts, the quick-closing valve, the trip head, and the speed limit. The stop may be operated electrically or mechanically or by combining the two methods.

Whether electrically or mechanically operated the result is the same: over-speeding of the engine is impossible. The "Speed Limit" device at the first instant of "Running Away," as evidenced by the increased speed of the line shaft, throws out a trip, which lets fall a rod and operates the "Quick Closing Valve." As soon as the trip is released, an alarm bell starts ringing and continues to ring until the trip head is reset. The engine having been brought to a stop by the closing of the quick acting valve, cannot be started until the stop has been reset.

### CIRCUIT CLOSERS

At any desired points in the Engine room or about the mill, circuit closers may be installed as shown in the accompanying illustrations, the action of which in stopping the engine is practically instantaneous.



Trip Head Combined  
Electrical and Mechanical

### NO BELTS, CHAINS, GOVERNORS, ETC.

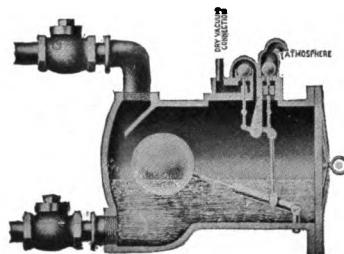
The action of the Strong Engine Stop is not dependent upon any of the devices named above, but is so simple and effective that we sell and install it under the same guarantee that applies to all "Strong" Specialties.

*"We don't want a cent of money until you are satisfied."*



Circuit Closer for  
Strong Engine Stop

# THE STRONG, CARLISLE & HAMMOND CO.



Strong Vacuum Trap

The Strong Vacuum Trap automatically removes water from the vacuum lines of condensing engines, from the receivers of compound engines, from vacuum oil separators, etc., thus preventing accidents which might otherwise occur from the back suction of water into engine cylinders.

The Strong Vacuum Trap is also designed for returning condensation from coils, radiators, etc. of low pressure heating systems, direct to the boiler.

**CONSTRUCTION.**—The Trap consists of a cylindrical shaped body made from a high grade of cast iron, to which is bolted the head. This joint is machined and absolutely tight. To the top of the trap is attached the frame for the valves with a dry vacuum and atmosphere ports as shown by cut. Into this frame are screwed the seats for the vacuum and atmospheric valves. The valves consist of ground brass balls, operated by levers having heavy phosphor bronze bearings. The mechanism is operated by a Hercules patented copper float connected by heavy phosphor bronze and brass rods. No steel or iron is used in the working parts. The traps have no trunnions to adjust, no stuffing boxes to pack, no tilting devices to balance, and REQUIRE NO STEAM TO OPERATE THEM when discharging the water to the atmosphere and only a sufficient amount of steam to balance the back pressure when discharging to an elevation.

There is not a delicate part in their construction. The valves are in the top of the trap and may be inspected by removing the small caps encasing them. It is impossible for dirt to get at the working parts, as they are above the water line and almost the length of the trap away from the inlet. Every trap is inspected and rechecked before leaving our factory, and is ready to go into service.

TABLE OF SIZES AND CAPACITIES

Size No.	Outlet and Inlet	Distance Floor to Inlet	Total Length	Total Height	Diameter Body	Diameter Flange	Capacity Gallons Hour Over	Shipping Weight	List Price
	Inches	Inches (Center of Inlet)	Inches	Inches	Inches	Inches			
8	1½	16	24	23	11	14	400	235	\$120.00
9	2	21½	28	29	18	20½	700	410	200.00
10	2½	21½	28	29	18	20½	1000	410	200.00
11	3	21½	28	29	18	20½	1600	410	200.00

Swing check valves are furnished for inlet and outlet. Ball and lift checks should not be used.  
Discount on application

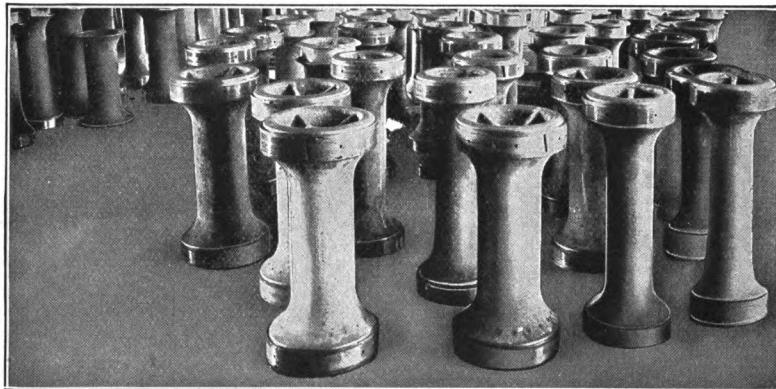
# AMERICAN BALANCE VALVE CO.

JERSEY SHORE, PENNA.

**BALANCED VALVE SPECIALISTS**

Since 1890

**DISTRIBUTION VALVES**

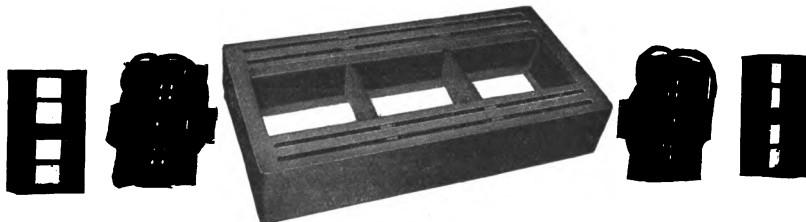


SEMI-PLUG Piston Valves for Superheated Steam or Saturated Steam of any Pressure up to 1000 Pounds.

These Valves are Frictionless, are Steam-tight and *REMAIN SO*. They are Maintained by DUPLICATE parts from STOCK. When under Pressure this Valve is a PLUG and when without Pressure it is a Snap Ring Valve.

Can be fitted to any Piston Valve Engine.

The Jack Wilson High Pressure Double-Ported Slide Valve for Pressures up to 240 lbs. and Superheat to 600° F.



BALANCED in all positions of travel. Double Admission, Double Exhaust and made for Internal or External Admission.

Can be fitted to any Slide Valve Engine.

When Designing or Repairing Engines, you should investigate these Modern Balanced Valves.

# THE LOMBARD GOVERNOR CO.

ASHLAND, MASS.

**HYDRAULIC GOVERNORS FOR ALL PRIME MOVERS; WATER RELIEF VALVES,  
MECHANICALLY AND HYDRAULICALLY OPERATED; SPEED-RECORDING AND  
INDICATING INSTRUMENTS; WATER-LEVEL RECORDERS AND FREQUENCY  
RECORDERS.**

## STANDARD GOVERNORS

Type	Style	Capacity in ft. lbs. per stroke	Shipping Weight in pounds	Time of stroke in seconds
F	Horizontal	2,500	2,000	1
R	Vertical	2,500	2,550	1
M	Horizontal	4,500	2,500	2
P	Horizontal	6,700	2,500	3
PS	Horizontal	6,700	2,600	1
R6"	Vertical	6,700	3,150	3
Q6"	Vertical	6,700	3,250	1
O6"	Horizontal	10,000	3,000	4
OS6"	Horizontal	10,000	3,100	1
R7½"	Vertical	10,000	3,400	4
Q7½"	Vertical	10,000	3,500	1
O7½"	Horizontal	16,000	3,250	4
OS7½"	Horizontal	16,000	3,350	1
Q10"	Vertical	20,000	7,300	1
NS	Vertical	30,000	7,500	2
N14"	Vertical	60,000	11,500	3

A large part of our business is the designing and building of special governors for direct connection without the use of gears or other intermediate devices

## GOVERNOR ACCESSORIES

Electric Speed Controls of various types for manipulation of governors from switchboards or any distant points.

Safety Emergency Stop device; can be arranged for distant control.

Pressure-Control Mechanism for governing at variable speed and constant pressure of air or water.

Pipe Line Pressure-Equalizing Device, for reducing water hammer.

Water Relief Valves, in sizes 3" to 23", to meet all requirements.

Precision Tachometer, 10" dials; scales calibrated to order.

Speed Recorder for permanent and accurate records.

Electrical Long Distance Speed Indicators, for transmitting speed indications to any point.

Frequency Recorders for permanent and accurate records.

Water-Level Recorders; draws large scale curves.

# THE PICKERING GOVERNOR CO.

PORLTAND, CONNECTICUT

GOVERNORS FOR STEAM ENGINES, GAS ENGINES, STEAM TURBINES,  
MECHANICAL CONTROL AND POWER REGULATION.

Owing to the absence of joints our Governors are very responsive to slight changes in load, moving quickly and positively into correct position for maintaining the admission of steam proportionate to the duty required of the engine. Absence of joints gives maintenance in efficiency under continued and severe duty.

Speed Rangers are incorporated, permitting wide range in adjustment of Engine speed while running.



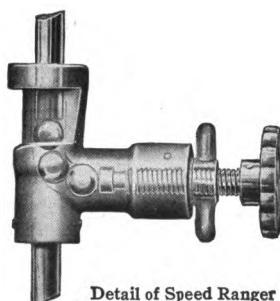
Class A



Class B Vertical

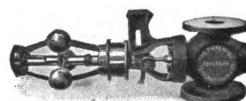


Gov. with Stop Valve



Detail of Speed Ranger

Class A Governors are equipped with safety stop which shuts off steam from the engine if governor drive belt should break. Class B are not equipped with safety stop. Horizontal B is never provided with safety stop. Governor with stop valve does away with joint between governor and valve.



Class B Horizontal

TABLE OF DIMENSIONS, ETC., FOR CLASSES A AND B

Diameter of Opening Size of Governor	1½	1¾	2	2½	2¾	3	3½	4	4½	5	6	7	8	9	10
From center of inlet to base	3½	3½	4½	4½	5½	5½	6½	7½	7½	8	8½	9	10	11½	11½
Extreme Height	20½	23½	25½	27½	27½	32½	33½	41½	41½	46½	49½	49½	53½	55½	60½
Extreme expansion of Balls	7	8	8	9	9	10	10	13	13	15	16½	16½	18	20	20
Speed of Governor	350	380	380	300	300	340	340	320	320	275	275	275	260	260	225
Dia. of Pulley on Gov	2½	3½	3½	4	4	4	4	5	5	5	6	7	7	8	8
Dia. of Cyl. 300 ft. Piston Sp.	6	6	9	10	12	14	16	18	20	22	26	31	36	40	45
" " " 400 " " "	5	6	8	9	10	12	14	16	18	20	23	27	31	35	39
" " " 500 " " "	4½	5	7	8	9	10	12	14	16	18	21	24	28	31	35
" " " 600 " " "	4	4½	6	7	8	9	11	13	15	16	19	22	25	28	32

For complete table and for sizes below 1½--see our general catalogue.

# WATERS GOVERNOR COMPANY

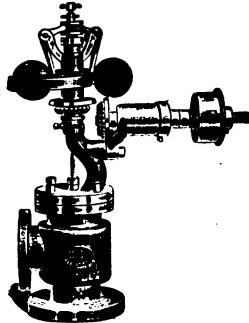
1122 OLIVER BLDG., BOSTON, MASS.

## REDUCING VALVES AND ENGINE GOVERNORS

### ENGINE GOVERNORS

These Governors are suitable for every variety of stationary and portable steam engine. They have adjustable speed regulation, automatic safety stop, Sawyer's lever, solid composition valves and seats, and all parts interchangeable.

The Waters Governors have been in use over forty years and have steadily grown in favor since their introduction. The design is such that they are not affected by the action of gravity, the weight remaining always in the same plane. The valve is of large area, greatly in excess of the steam pipe, and being quick acting and sensitive, insures economical results as well as close regulation. The valves are evenly balanced and have large openings with small travel.

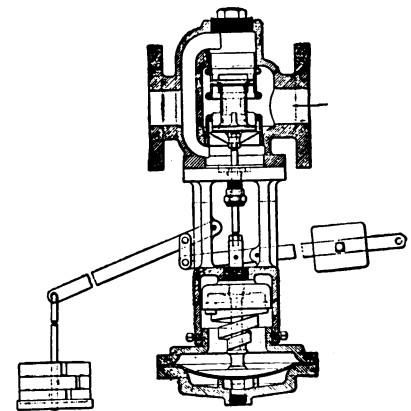


Catalog on Request.

### REDUCING VALVES

The accompanying illustration shows our Improved Reducing Valve. The "simplicity" of its construction can readily be seen and appreciated, while its "accessibility" can also be noted at a glance.

Diaphragm is connected by a  $\frac{1}{2}$  inch pipe with the low pressure side, and the pressure in the diaphragm chamber, working against the spring, tends to close the valve, spring opening the valve when the pressure falls. A wide range of reduced pressures can be easily and quickly obtained. Particularly desirable for steam heating purposes. The square weight, fastened with a set screw, is simply a counter-weight, to be moved in or out as the case may be, to obtain any pressure in between any two weights placed on the scale pan. These valves require no head room, hanging below the line of piping, and can be removed downward, leaving valve chamber only in line of pipe.



head room, hanging below the line of piping, and can be removed downward, leaving valve chamber only in line of pipe.

We wish to emphasize the fact that with Waters Valves it is not necessary to buy a special valve with outlet larger than inlet, at increased cost. With our valves an enlarged outlet flange answers exactly the same purpose, because the control to operate our valve is taken outside the valve itself. Valves and seats made of a special mixture can be furnished for use with superheated steam. All parts made interchangeable. Our diaphragms are made of special flat stock and shape themselves. In an emergency any good sheet packing can be used temporarily. A special valve for vacuum heating systems is made with very large diaphragm and double-ended single lever, to reduce to atmosphere or below.

Write for Catalog.

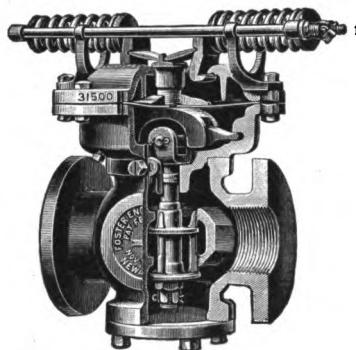
# FOSTER ENGINEERING CO.

NEWARK, N. J.

MANUFACTURING ENGINEERS OF AUTOMATIC VALVE SPECIALTIES

BRANCH OFFICES: CHICAGO PHILADELPHIA BOSTON PITTSBURGH

## PRESSURE REGULATOR—CLASS "W"



For Maintaining a Constant Uniform Delivery Pressure from a Higher Initial Regardless of Variations in the Boiler Pressure or Source of Supply. For Service on Steam, Water, Gas and Air.

Its "compensating spring and toggle lever arrangement" makes it phenomenally sensitive, accurate and reliable. Has no weights, levers, or close-fitting piston or parts to cause friction. Very simple in construction and adjustment. Made in sizes  $\frac{1}{2}$ -inch to 1-inch of composition; larger sizes, iron body, composition mounted. Sizes  $2\frac{1}{2}$ -inch and up are fitted with *renewable seats*, forged steel stem and levers—insuring durability and minimum repairs. Thousands are in use today in all civilized countries and is the "standard" of many large power and manufacturing plants.

### LEADING FEATURES:

1. Full compensating spring movement, exerting an unvarying pressure on the dia-phragm.
2. Renewable seat rings.
3. Drop forge stem, levers, toggle levers (case hardened) insuring durability.
4. Great simplicity of construction and operation.
5. Full steam way through the valve.
6. Small movement of dia-phragm—insuring long life.
7. No friction of parts—note illustration.
8. No small ports to clog.
9. No dash pot.
10. Noiseless—no chatter.
11. Absolutely automatic after adjustment as to pressure.
12. Every regulator carefully tested at pressure ordered before leaving factory.

### ORDERS FOR PRESSURE REGULATING VALVES SHOULD SPECIFY:

1. Initial or boiler pressure.
2. Maximum and minimum delivery pressure.
3. Connections—screwed or flanged ends, giving diameter.
4. Sizes of both pipes leading to and from regulator.
5. Device or system to which it is to be applied.
6. For high or low pressure service.
7. Size of valve preferred and if we will be permitted to send a smaller size if we deem a smaller valve will give better results. By following our suggestions we often save considerable money for our users.
8. Any additional information towards an intelligent understanding of your requirements will insure your receiving a valve best suited to meet conditions.

## FOSTER CLASS "G" PRESSURE REGULATING VALVE FOR INTERMITTENT SERVICE

A decided innovation, so extremely sensitive and reliable that delivery pressure may be adjusted from zero to within a fraction of the initial pressure, and at point of adjustment the delivery will remain constant, regardless of variation in initial pressure or volume of discharge.

Will operate equally well on horizontal or vertical pipe; upright, inverted or inclined at any angle.

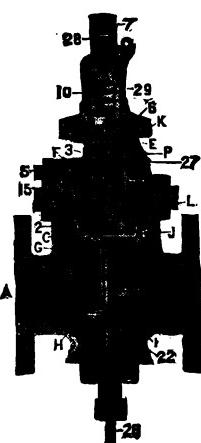
Although of wide range of operation, no part of this valve is of delicate construction or easily deranged.

Orders should state initial and delivery pressures, connections, service and approximate volume of discharge. (See above.)

Made in all sizes,  $\frac{1}{2}$ -inch to 12-inch. Sizes 2-inch and smaller of composition only. Larger sizes, iron body, composition trimmed. Screwed and flanged connections. Also make larger sizes in composition on order only.

Prices on application.

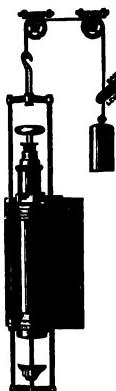
Write for complete Catalogue.



# JULIAN D'ESTE COMPANY

24 CANAL ST., BOSTON, MASS.

BRASS FOUNDRERS, FINISHERS AND MACHINISTS, SOLE MANUFACTURERS OF CURTIS ENGINEERING SPECIALTIES, INCLUDING DAMPER REGULATORS, IMPROVED PRESSURE REGULATORS, IMPROVED PUMP REGULATORS, WATER PRESSURE REGULATORS, EXPANSION TRAP, RETURN STEAM TRAP, BALANCED STEAM TRAP, RELIEF VALVE FOR STEAM AND WATER, STEAM SEPARATOR, TEMPERATURE REGULATOR, PUMP GOVERNOR AND PUMP, BLOWER VALVE, CELLAR DRAINER, U. S. BALL COCK, ETC.



Damper Regulator

## THE CURTIS IMPROVED (PATENT) DAMPER REGULATORS

The plunger is operated by steam direct from the boiler, and the whole pressure in the boiler is therefore available to operate the damper if needed. In practice, only enough pressure is used to lift the weight, usually not more than ten pounds to the square inch on the plunger.

The motion of the damper will begin to change from one direction to the other on a variation of steam pressure of one half of a pound either way from the point at which it is set to operate.

We guarantee a saving of ten per cent of the fuel over the best hand regulation or the old style (diaphragm and lever regulator), and it often reaches fifteen per cent.

They are sent on thirty days' approval and will pay their cost by the saving of fuel in one year. *Three Standard Sizes.*

## IMPROVED STEAM PRESSURE REGULATORS

This regulator is made entirely of metal, occupies the same space as a globe valve for the same size pipe, and is very simple and sensitive.

By its use steam may be maintained at high pressure in boilers, and yet be reduced for heating to two or three pounds.

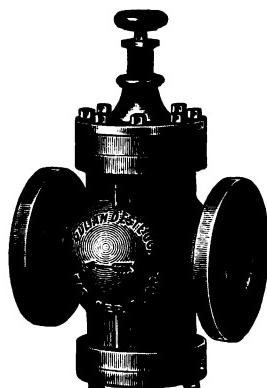
In the best engineering practice the exhaust steam of the engine and elevator is turned into the heating system of a building, and the Regulator automatically supplies just the amount lacking to maintain constant pressure in the pipes and radiators.

Standard sizes for 1,  $1\frac{1}{4}$ ,  $1\frac{1}{2}$ , 2,  $2\frac{1}{2}$ , 3, 4, 5, 6, 7, 8, 10, 12, 14, and 16 inch pipe.

A lockup top furnished at small additional cost.

## THE CURTIS BALANCED STEAM TRAP

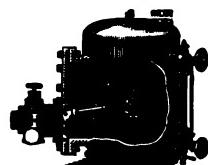
Some Points of Superiority



Steam Pressure Regulator

1. A perfectly balanced valve.
2. An absolutely frictionless valve.
3. The valve can be removed without breaking a joint, starting a gasket, or taking out a bolt.
4. The valve being frictionless and balanced, the whole power of the float is available for opening and closing the valve.

5. The copper float is perfectly spherical, hard, as hermetically sealed as a glass globe, is of uniform thickness and warranted strong and tight at 250 lbs. pressure.
6. It has a pass-by valve to insure constant operation.
7. Each trap will operate perfectly on pressures varying from one to 250 pounds.



Balanced Steam Trap

## PRICE LIST

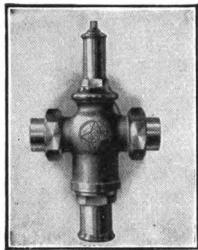
*Size and Condensing Capacity in Feet of One-Inch Pipe*

No. 000,	\$15.00 for 1,000 feet	$\frac{1}{2}$ in. inlet and outlet
No. 0,	20.00 for 2,000 feet	$\frac{3}{4}$ in. inlet and outlet
No. 0,	25.00 for 3,000 feet	$\frac{3}{4}$ in. inlet and outlet
No. 1,	30.00 for 5,000 feet	$\frac{3}{4}$ in. inlet and outlet
No. 2,	40.00 for 8,000 feet	1 in. inlet and outlet
No. 2 $\frac{1}{2}$ ,	55.00 for 15,000 feet	$1\frac{1}{4}$ in. inlet and outlet
No. 3,	75.00 for 30,000 feet	$1\frac{1}{2}$ in. inlet and outlet
No. 4,	100.00 for 40,000 feet	2 in. inlet and outlet
No. 5,	125.00 for 60,000 feet	3 in. inlet and outlet

## THE MASON REGULATOR CO.

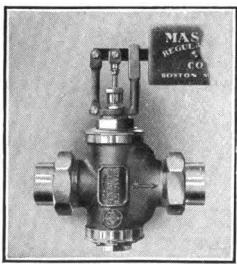
BOSTON, MASS.

REGULATING APPLIANCES FOR STEAM, WATER OR AIR. A partial list of our product is given below. For a more complete and detailed description of the following and of many other devices, see our general catalog.



### MASON ALL-BRONZE REDUCING VALVES

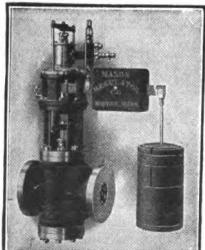
The Mason Standard Reducing Valve reduces and maintains even pressure of steam or air regardless of the variation of the initial pressure or of the volume of steam or air required. It automatically reduces boiler pressure for steam heating systems of all types (vacuum systems included), central heating plants, engines, paper machines, slashers, dye kettle and all situations where it is desirable to use a lower pressure than that on the boiler.



### MASON ALL-BRONZE BALANCED VALVES

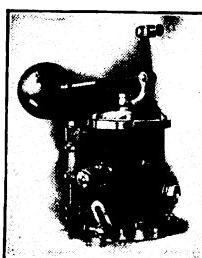
Mason All-Bronze, Balanced Valves with Yoke and Lever, are used to control pumps, engines, and the like, by means of tank floats or cords to distant points, and also in connection with various devices for controlling the flow to water wheels, receivers, open heaters, and other similar devices. They can be relied upon in any situation requiring a valve to be operated with a minimum amount of power.

### MASON STEAM PUMP PRESSURE REGULATOR FOR HYDRAULIC ELEVATOR SERVICE



The Mason Steam Pump Pressure Regulator for Hydraulic Elevator Service was designed to meet the requirements of the larger sizes of steam pumps operating hydraulic elevators. The important features of this regulator are its extreme sensitiveness and quick action, as it completely opens or closes the steam valve with the slightest variation of pressure.

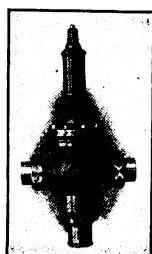
The Mason Steam Pump Pressure Regulator for Hydraulic Elevator Service has been extensively used during the past fifteen years for controlling steam pumps operating hydraulic elevators, thousands of them being in use and giving entire satisfaction.



#### MASON STEAM PUMP SPEED GOVERNOR

The Mason Steam Pump Speed Governor is to the direct-acting steam pump what the ordinary ball governor is to the steam engine. It derives its motion from some reciprocating part of the pump and controls a balanced valve placed in the steam pipe, thereby exactly regulating the amount of steam to the requirements of the pump, and automatically maintaining a uniform speed, regardless of any variation of steam or load.

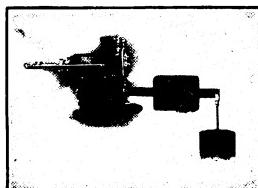
#### MASON STEAM PUMP PRESSURE REGULATOR



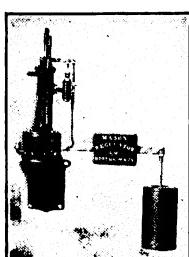
The Mason Steam Pump Pressure Regulator is designed for fire, boiler feed, air, and water works pumps, having steam supply pipe 4" or smaller, or any class of pumping machinery where it is necessary to maintain a constant pressure.

The regulator is entirely self-contained. It is placed in the steam supply pipe to the pump and connected by  $\frac{1}{4}$ " pipe to the discharge system, thereby exactly regulating the amount of steam to the requirements of the pump and automatically maintaining a uniform discharge pressure, regardless of any variation of steam pressure or demand on the pump. The regulator is provided with a dashpot, which positively prevents the pump from jumping under sudden changes of discharge pressure.

#### MASON HORIZONTAL PRESSURE-CONTROLLING DEVICE



The Mason Horizontal Pressure-Controlling Device, in its various modifications, is used for controlling power and electrically driven pumps of all types and on all classes of service, including vacuum systems. This device can be supplied with various sizes of diaphragms for vacuums, low pressures, and pressures up to 400 lbs., and with cup leather packed plungers for higher pressures up to 3000 lbs.



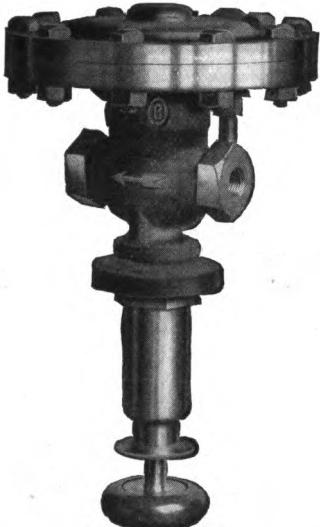
#### MASON HYDRAULIC DAMPER REGULATOR

The Mason belongs to that class of Regulators which are controlled by the variation of the boiler pressure, the motive power for opening or closing the damper being the water pressure, which can either be taken from the street main or from the boiler itself. A compensating arrangement is provided which prevents the Regulator from completely opening and closing the damper at each slight change of pressure.

## THE OHIO BRASS CO.

MANSFIELD, OHIO

OHIO STEAM SPECIALTIES



Ohio Regulating Valve

### OHIO PRESSURE REGULATING VALVE

FOR STEAM OR AIR

Patented

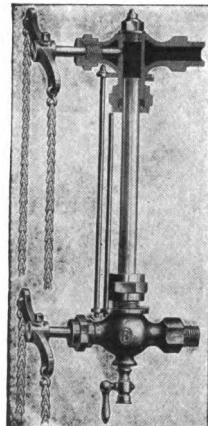
Reduces and regulates accurately and continuously.

Self-contained, no tight fits, will not stick.

Simple and rugged in construction.

Made in all bronze in  $\frac{1}{2}$  to 2 inches.

Made in iron body with bronze working parts in  $2\frac{1}{2}$  to 4 inches.



Ohio Water Gauge

### OHIO STANDARD GAUGE COCK

A simple twist of the wrist stops a leak.

Has babbitt disc "1" which is rotated to a tight seat by screw "2."

Made in  $\frac{1}{2}$  and  $\frac{3}{4}$  inch.



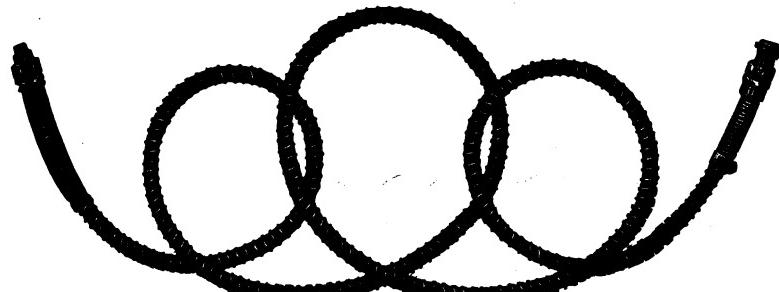
Ohio Standard Gauge Cock

Descriptive Catalog M.E. mailed on request

# THE AMERICAN METAL HOSE CO.

WATERBURY, CONN.

FLEXIBLE METAL HOSE AND TUBING FOR STEAM,  
OIL, AIR, GAS, WATER, ETC.



25-foot length. 1-inch BD20 Bronze Steam Hose, with packed couplings, re-enforced ends, and one end asbestos and canvas covered.

AMERICAN FLEXIBLE METAL HOSE is particularly adapted to conveying Oil and Steam, both of which quickly attack and destroy Rubber Hose. Our Hose is as strong in construction as is consistent with flexibility, will stand high pressures, and for conveying either of the above agents is most practical and economical. For both of the above purposes an Interlocked Hose is supplied, which is made from a continuous metal ribbon or strip wound spirally over itself, the edges being crimped or turned in during the winding to form the Interlocked Joint shown in illustration; a specially prepared asbestos cord fed into a separate groove in the strip during the winding acting as a packing and making the Hose tight.

For STEAM, our Standard is the Bare Interlocked Pattern, BD15 BRONZE HOSE with I. P. T. Brass Couplings attached. These Couplings are threaded internally to screw onto the spiral groove on the outside of the Hose and are packed on with a stuffing box of asbestos and red lead, making a tight connection. Each coupling is provided with a Flexible Metal re-enforced end which is fastened under a shoulder prepared for it on the Coupling and extends a short distance from the Coupling over the end of the Hose, giving a double thickness of metal at the point where there is the greatest strain.

FLEXIBLE STEEL HOSE, Style BD15 is admirably adapted to conveying Oils, its life being actually prolonged by contact with them. The smaller sizes are used in numberless connections, the principal one being for Oil Feed purposes on machinery. The larger sizes are used extensively in unloading and barrel filling work. Couplings for Oil Hose are generally sweat on.

While the Bare Interlocked Hose, Style BD15, is suitable for ordinary work and pressures, there are instances when the Hose is subjected to constant handling, where a stronger type is required. To meet this demand we supply our BD20 Hose, which is covered with a braiding of fine BRONZE or STEEL Wire and a Spiral Armor Wire. This covering does not affect the flexibility of the Hose, but is most efficient as a protection where hard usage is unavoidable, and by reason of its greater strength makes the Hose suitable for higher pressures.

## SIZES

We carry BD15 and BD20 HOSE in stock, both in STEEL and BRONZE in the following sizes:  $\frac{3}{16}$ ",  $\frac{1}{4}$ ",  $\frac{5}{16}$ ",  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{3}{4}$ ",  $1"$ ,  $1\frac{1}{4}"$ ,  $1\frac{1}{2}"$ ,  $2"$ ,  $2\frac{1}{2}"$ , and  $3"$  internal diameter. Larger sizes furnished on order.

Full information on our FLEXIBLE METAL AIR and WATER HOSE and GAS TUBING, or on Special Hose for extreme pressures, furnished on application.

Interlocking Construction B. D. 15 Hose



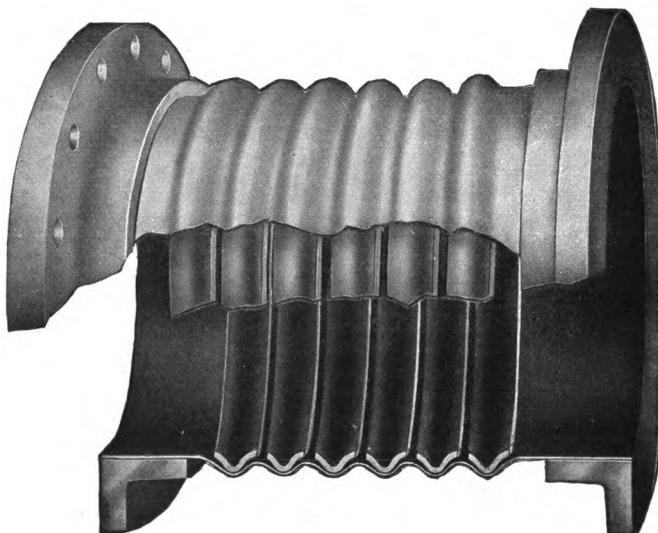
## *Expansion Joints*

**E. B. BADGER & SONS CO**

63-75 PITT ST.

BOSTON, MASS.

### **COPPER EXPANSION JOINTS**



#### **BADGER'S COPPER EXPANSION JOINTS**

Will take care of the expansion and contraction in pipe lines, absorb vibration in engine and turbine exhausts, etc.

Our regular joints are built in sizes from 1" to 7' 0" in diameter; larger joints constructed for special work.

These joints may be employed in high pressure, vacuum or exhaust lines; the construction suits the particular case.

The principal difficulty with expansion joints has been in the unequal distribution of the expansion among the different corrugations, resulting in excessive strain on, and probably rupture of, one of the corrugations.

Our patented internal and external equalizing ring construction prevents any one corrugation from doing more than its share of the work, and provides at the same time a stiffer and stronger joint.

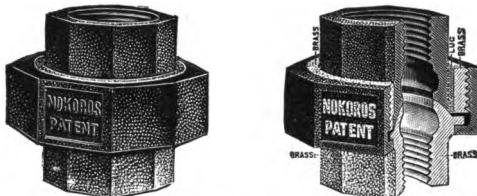
As to amount of expansion: Our 12" diameter, 3 corrugation, 12" face to face joint will take up easily 1½" expansion; others in proportion to diameter, number and size of corrugations, etc.

Unless otherwise specified, we furnish standard A.S.M.E. flanges.

*Write for full particulars.*

## ILLINOIS MALLEABLE IRON CO. 1801-25 DIVERSEY PARKWAY, CHICAGO, ILL.

### THE NOKOROS PATENT UNION



The only Union made absolutely NON-CORROSISS at all contact points.

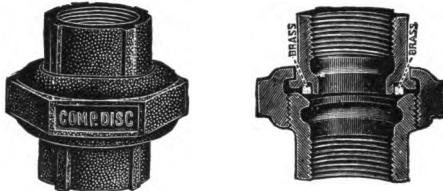
Non-corrosive Brass to Iron thread connection.

Non-corrosive Brass to Iron seat between ring and tail-piece.

Octagon shape, a monkey wrench will turn.

Size, inches.....	1/4	5/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Plain, each.....	.19	.22	.27	.40	.48	.66	.80	1.14	2.10	2.65
Galvanized, each.....	.23	.26	.34	.49	.60	.82	1.10	1.40	2.75	3.50

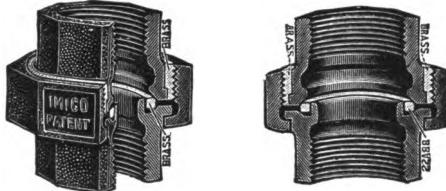
### THE COMPRESSION DISC PATENT UNION



Heavy Pattern Air Furnace Malleable Iron with Brass Valve Seated Disc. The face of each threaded section is beveled to receive a brass disc, and the connecting up of the union COMPRESSES the brass DISC against the recesses, making a permanent steam metal seat.

Size, inches.....	1/4	5/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Plain, each.....	.30	.40	.50	.60	.80	1.20	1.60	2.00	3.20	4.80
Galvanized, each.....	.45	.60	.75	.90	1.20	1.80	2.40	3.00	4.80	6.20

### THE NEW IMICO PATENT UNION



New Imico Unions are made of non-corrosive malleable iron, extra heavy, with bronze metal valve seated disc and non-corrosive ring connection.

Size, inches.....	1/4	5/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Plain, each.....	.30	.40	.50	.60	.80	1.20	1.60	2.00	3.20	4.80
Galvanized, each.....	.45	.60	.75	.90	1.20	1.80	2.40	3.00	4.80	7.40

Also Mfr's of

### MALLEABLE and CAST IRON FITTINGS

Write for Catalogue

*Unions and Flanges*

# JEFFERSON UNION COMPANY

LEXINGTON, MASS.

UNIONS AND FLANGES FOR OIL, STEAM, WATER AND GAS UNDER ALL PRESSURES. Malleable iron only is used for standard goods and brass tubing for rings for seats.

Three Part

STYLE B FLANGE (Fig. 3)

Pipe Size	1	1½	2	2½	3	3½
Outside Diameter.....	2½	3½	3½	4½	4½	5½
Length Over all.....	2½	2½	2½	2½	3½	3½

Pipe Size	4	4½	5	6	7	8	9	10
Outside Diameter.....	9	9½	10½	11½	12½	14	15	16½
Length Over all.....	4½	4½	4½	4½	5½	5½	5½	5½

Two Part

STYLE D FLANGE (Fig. 4)

Pipe Size	1	1½	2	2½	3	3½
Outside Diameter.....	2½	3½	3½	4½	5	5½
Length Over all.....	2½	2½	2½	2½	3½	4½

Pipe Size	4	4½	5	6	7	8	9	10	12
Outside Diameter.....	8½	9½	10	11½	12½	13½	15½	16½	18½
Length Over all.....	4½	4½	4½	5½	5½	5½	5½	6½	6½

STYLE E FLANGE (Fig. 4)

Two Part—Extra Heavy

Pipe Size	1	1½	2	2½	3	3½	4
Outside Diameter.....	4½	4½	5½	6	6½	7½	8½
Length Over all.....	3½	3½	4½	3½	4½	4½	5½

Pipe Size	4½	5	6	7	8	9	10
Outside Diameter.....	10½	10½	12½	13½	14½	16½	17½
Length Over all.....	5½	5½	5½	6½	6½	6½	7½

Jefferson Style A Unions (Fig. 2) are made with spherical brass to iron seats ground to a perfect fit. The ring *A* is of wrought metal, cut from seamless brass tubing, avoiding blowholes common in cast brass. There are special advantages in the use of the brass ring in just the manner shown and the wall *B* is patented owing to these advantages, which include protecting the brass from injury no matter how far the pipe is screwed in. No gasket is used and there is plenty of play for the part *F* which swivels in the nut. Dimensions are given in following table.

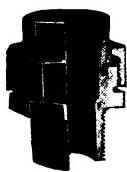


Fig. 1

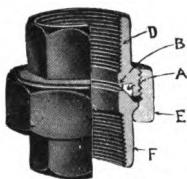


Fig. 2

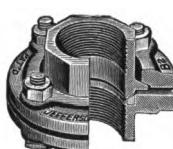


Fig. 3

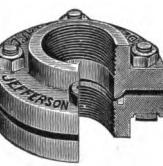


Fig. 4

**STYLE A UNION**  
"Standard Type" All Female

Pipe Size	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	1	$1\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{1}{2}$	$8\frac{1}{2}$
Diameter Nut (Across Flats).....	$1\frac{1}{8}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$3$		
Length Over all.....	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	

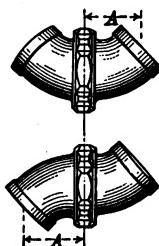
Pipe Size	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{1}{2}$	$8\frac{1}{2}$	$9\frac{1}{2}$	$10\frac{1}{2}$	$11\frac{1}{2}$
Diameter Nut (Across Flats).....	$3\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{1}{2}$								
Length Over all.....	3	$3\frac{1}{4}$	$3\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$								

The Jefferson Style F Union (Fig. 1) is short and more easy to use than the union and nipple which it replaces. It has Briggs Std. pipe threads. Any kind of wrench may be used on any of its parts.

**STYLE F UNION**  
Male and Female

Pipe Size	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3
Diam. Nut (Across Flats)...	$4\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	3	$3\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$
Length Over all .....	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$

**SWING UNION**



Pipe Size	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$
Diam. Nut (Across Flats).....	$1\frac{1}{8}$	$1\frac{1}{8}$	$1\frac{1}{8}$	$1\frac{1}{8}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$
Length A.....	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$

Pipe Size	1	$1\frac{1}{2}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$
Diam. Nut (Across Flats).....	$2\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$
Length A.....	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$

# BEST MANUFACTURING CO.

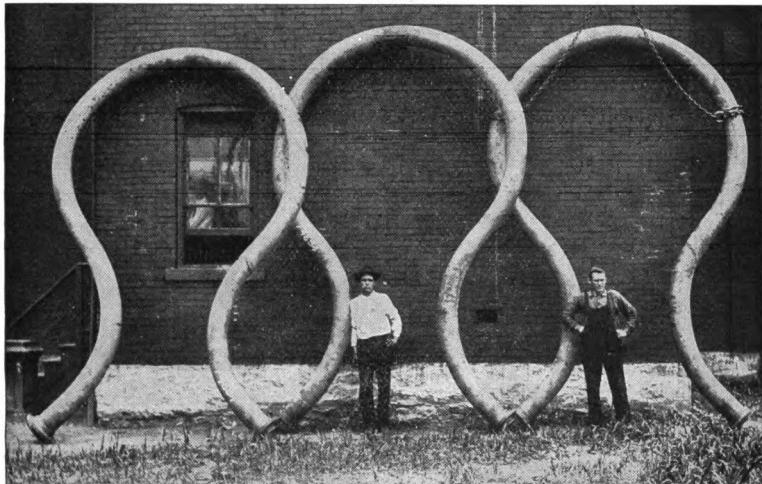
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WORKS, - OAKMONT, PA.

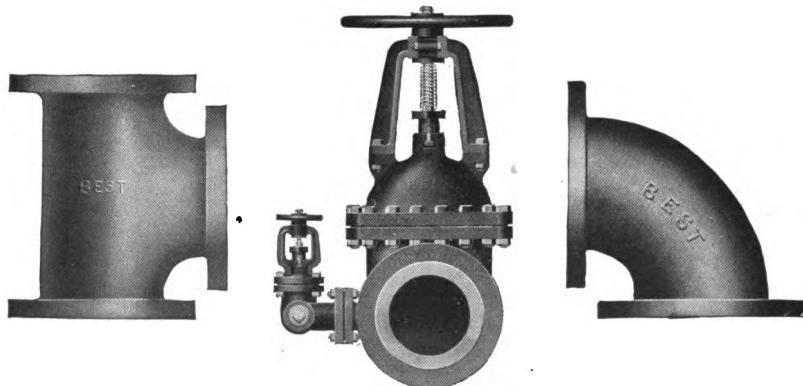
PIPE

VALVES

FITTINGS



FABRICATED PIPING WORK FURNISHED COMPLETE—DESIGNS FOR PLANT SYSTEMS SUBMITTED.



PIPING—For all services, all pressures.

VALVES—All Iron, Semi-Steel, Cast Steel. "Best" Double Adjustable wedge Gate Valves.

FITTINGS—Iron, Brass, Semi-Steel, Cast Steel.

SPECIALTIES—Welded and Vanstone Flanges, Welded Headers, Large Castings, "Best" and Moran Type Flexible Joints, Bosh Piping, Tuyere Cocks, etc.

1912 CATALOG No. 103—Illustrating our line, sent upon request on company letterhead.

# THE CHAPMAN VALVE MFG. CO.

INDIAN ORCHARD, MASS.

**STEEL PARALLEL SEAT, DOUBLE GATE VALVE FOR SUPERHEATED STEAM  
STEEL BODIES AND BONNETS, MONEL METAL GATES AND SEATS**

## STRAIGHTWAY TYPE

Fig. 312 is a cut of the internal working parts, showing the carrier block extended to carry an opening the full size of the pipe line, so that when the valve is fully open the seats are covered and the pipe line is made continuous, the carrier extension effectually filling up the aperture around the seats.

The valve when open is the same as if it were a continuation of the pipe line, with neither contractions or apertures of any kind to deflect or break up the flow of the steam. This construction not only prevents the loss of head due to eddying, but it also protects the seats from injury.

Diameter of Port or Size=A  
Face to Face Flanges=B  
Diameter of Flanges=C

Fig. 311



A	2	2½	3	3½	4	4½
B	10¼	12½	14	14¾	18½	18½
C	6½	7½	8¼	9	10	10½
A	5	6	7	8	9	10
B	18½	19	20	20½	21⅓	22⅓
C	11	12½	14	15	16	17½
A	12	14	16	18	20	24
B	23¾	25½	32½	33¼	35¼	35½
C	20	22½	25	27	29½	34

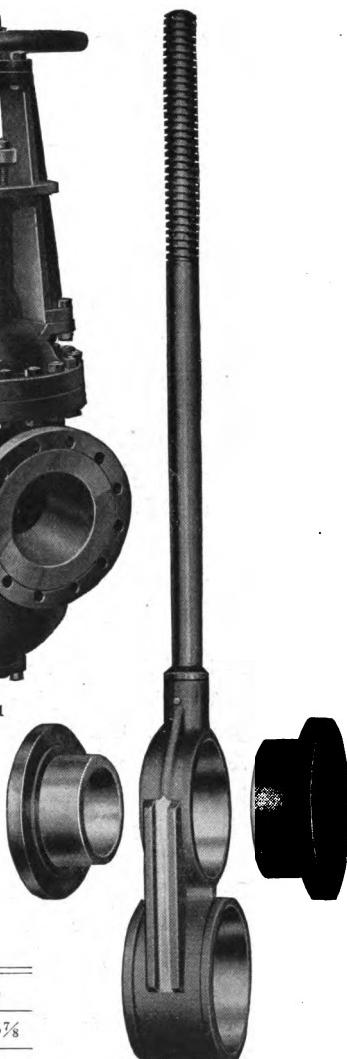


Fig. 312

PAGES 64-65 CATALOGUE NO. 30

# THE DARLING PUMP & MFG. CO. Ltd.

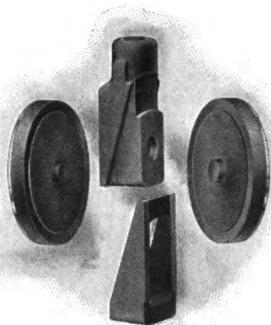
## WILLIAMSPORT PA.

Sales Offices:

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Boston, 141 Milk Street

DARLING GATE VALVES, FIRE HYDRANTS INDICATOR POSTS, FLOOR STANDS,  
VALVE BOXES, BALL CHECK VALVES, MADE FOR ALL  
PRESSURES AND PURPOSES



Wedging Mechanism—Shown with  
Parts Separated

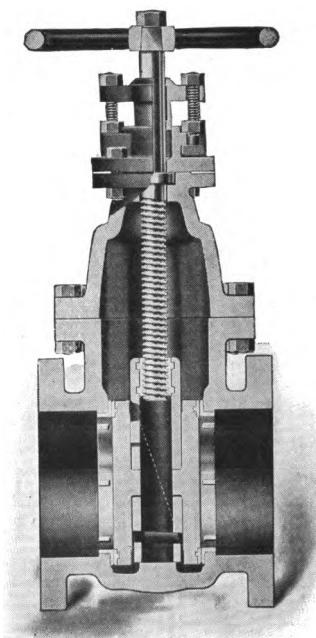
The Gate Discs being plain, no portion of the Wedging Mechanism is formed upon them. These Gate Discs revolve independently of the wedges, and independently of each other. The Revolving Gate Discs change their positions on the Seats each time the Valve is closed, thus distributing wear equally over entire Faces of Gates and Seats, ensuring Durability.

Gates Released Before Opening,  
Avoiding Wear on Seats.

Cannot Stick or Bind.

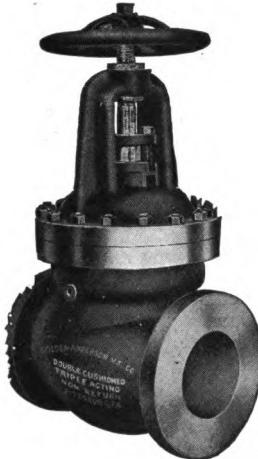
Simple, Reliable, Durable.

The Darling Patented Gate Valve has Parallel Seats, Double Revolving Gate Discs and Compound Equalizing Wedges. The Wedging Mechanism operates Between the Gate Discs and Independent of them.



Sectional View of Inside Screw Valve  
with Flanged Ends

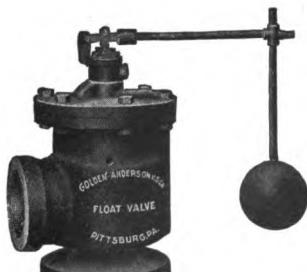
GOLDEN-ANDERSON VALVE SPECIALTY CO.  
1219 FULTON BLDG. PITTSBURGH, PA.  
STEAM AND WATER SPECIALTIES



Triple Non-Return Valve



Controlling Altitude Valve



Float Valve—angle or straight-way

AUTOMATIC DOUBLE-CUSHIONED TRIPLE-ACTING NON-RETURN VALVES  
(Angle or Globe)

"Works Both Ways;" automatically protects the boilers and steam lines.

Placed in the boiler outlet this valve will permit the passage of steam to the header or main, as required in regular service, but will close quickly against a reversal of the current. In case of accident to the boiler this valve will isolate the disabled unit from the rest of the battery, thereby not only reducing the destructive results of the accident, but also confining the damage to this one boiler and avoiding, oftentimes, the necessity for any interruption in the operation of the rest of the battery.

1000 of these were ordered by the largest steam users in the World for the protection of their power plants.

THE CONTROLLING ALTITUDE VALVES

Automatically maintain a uniform stage of water in standpipes, reservoirs or tanks.

No overflow in case of fire pressure.

Valves closed by water or electricity.

FLOAT VALVES

Instantly adjusted to operate quickly or slowly as desired. Indestructible.

They are an absolutely satisfactory Float Valve for high or low pressure.

ANDERSON REDUCING VALVES

For Steam or Water

are always cushioned in opening or closing. Regular sizes up to 24 in. dia.

Manufacturers  
also of  
**STANDPIPE  
VALVES,**  
**ELECTRO-  
HYDRAULIC  
VALVES,**  
**AUTOMATIC  
VALVES.**



Reducing Valve

# HOMESTEAD VALVE MANUF'G CO.

PITTSBURGH, PA.

THE HOMESTEAD SELF-LOCKING STRAIGHTWAY, THREE-WAY AND FOUR-WAY HIGH PRESSURE BALANCED PLUG VALVES. THE HOMESTEAD LOCKING COCK.

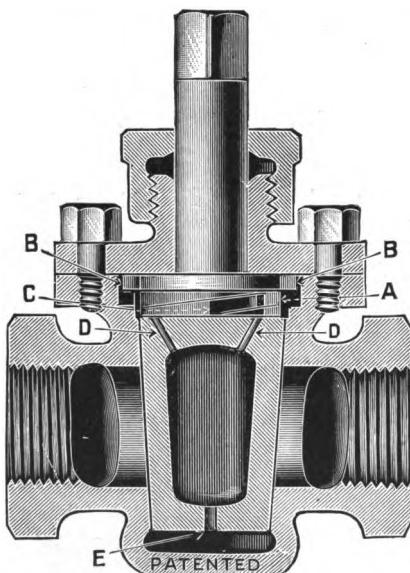
## THE HOMESTEAD SELF-LOCKING STRAIGHTWAY VALVE

This valve is unlike all others for the reason that when the pressure passes through it the seat is ABSOLUTELY PROTECTED FROM WEAR. The plug is balanced and held in place by the pressure when open, and when closed it is locked in the seat by our patent wedging cam, insuring freedom from friction in seat while plug is turning, which makes ours the quickest acting, simplest made, easiest operated and most durable valve known. Globe and Gate Valves, on the other hand, have their vital parts (Seats) EXPOSED to pressure and destruction every moment they are open.

### CONSTRUCTION

This valve is so constructed that when it is closed it is at the same time forced firmly to its seat. This result is secured by means of the traveling cam "A" through which the stem passes. The cam is prevented from turning with the stem by means of the lugs "B" which move vertically in slots. Supposing the valve to be open, the cam will be in the lower part of the chamber in which it is placed, and the plug will be free to be easily moved. A quarter of a turn in the direction for closing it causes the cam to rise and take a bearing on the upper surface of the chamber, and the only effect of further effort to turn the stem in that direction is to force the plug more firmly to the seat. A slight motion in the other direction immediately releases the cam and the plug turns easily, being arrested at its proper open position by contact of the fingers of the cam at the other end of its travel. E. D. D. are balancing ports which allow the pressure to predominate at the top of plug, holding it gently in its seat while valve is open. Made in all sizes up to six inches, and for all pressures up to 5,000 pounds per square inch. Made in Straight Way, Three and Four - Way Patterns.

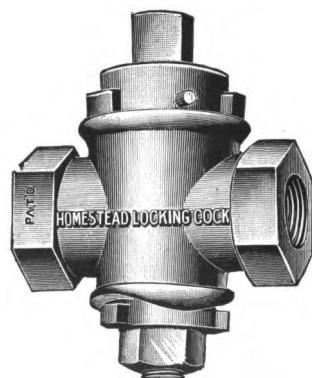
For Steam, Compressed Air and Hydraulic Service.



Homestead Straightway Valve

## THE HOMESTEAD LOCKING COCK

is made with a double external locking device, which forces absolutely tight adherence of the plug to the seat at each end of the quarter turn to which it is limited, insuring easy turning and almost entire freedom from wear, giving you SIMPLICITY, RAPIDITY and DURABILITY combined.



The Homestead Locking Cock

# THE KELLY & JONES CO.

GREENSBURG, PA.

Manufacturers of  
**BRASS AND IRON PIPE FITTINGS, BRASS AND IRON VALVES,  
COCKS, ETC.**  
**FOR STEAM, GAS, WATER, AIR AND OIL**

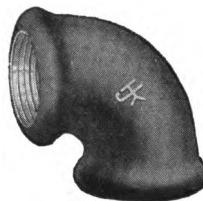


Cast Iron Fittings

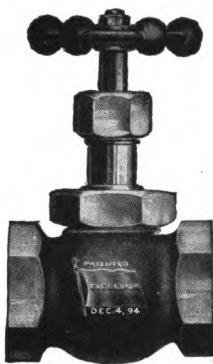
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All styles, screwed or flanged for all pressures.

All K. & J. cast iron fittings are made of the best grade iron, threads cut true to standard gauge and each fitting recessed.



Malleable Fittings



"Excelsior" Valves  
Brass—High Pressure

## MALLEABLE FITTINGS

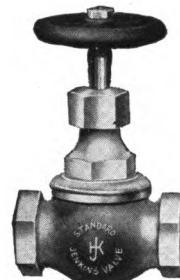
All styles—for all pressures.  
Plain, beaded or flat band.

## BRASS FITTINGS

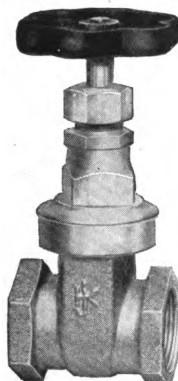
Screwed or flanged, rough or finished—standard or extra heavy.

## DRAINAGE FITTINGS

Our line of special recessed fittings for wrought iron drainage systems has been in satisfactory use for years.



Jenkins Disc Brass  
Valves



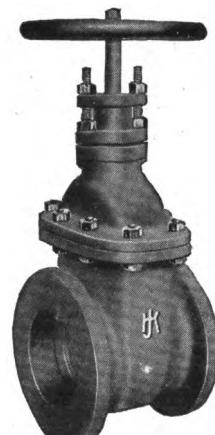
Brass Wedge Gate  
Valves

## BRASS VALVES

We make a brass valve for every purpose and each valve a perfect product. Only the best grades of raw material used and each valve thoroughly tested to pressure recommended.

## IRON BODY VALVES

Our line of iron body valves is most complete. We make every style and for all pressures.



Iron Body Wedge Gate  
Valves

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MANUFACTURERS OF JENKINS BROS. VALVES, PACKING, AND OTHER MECHANICAL RUBBER GOODS

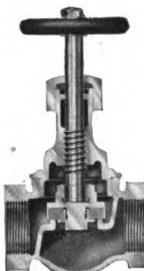


Fig. 105  
Sectional view of  
Brass Globe Valve  
Standard Pattern

### JENKINS BROS. BRASS VALVES

Jenkins Bros. Brass Valves, Standard Pattern, are made in globe, angle, cross, check, safety, Y and radiator patterns. They are the original renewable disc valves.

The Jenkins Discs, with which they are fitted, are of special rubber composition, readily adapting themselves to the raised seats ensuring absolutely tight closure. As there is no metal-against-metal contact of seats, there is less abrasion and wear, and the labor of regrinding is obviated. Jenkins Discs are inexpensive, give long service, and when worn out can be readily renewed without removal of valves from piping. As regularly supplied, valves are fitted with discs of hard composition for steam service. For cold water, air or gas, discs of softer composition are recommended. The valves are guaranteed for working steam pressures up to 150 pounds.

### JENKINS BROS. IRON BODY VALVES

Jenkins Bros. Iron Body Valves, Standard Pattern, are made in globe, angle, cross, check, Y, safety and back pressure patterns. They are heavy and strong. The working parts are similar in construction to the standard pattern brass valves, and they are regularly fitted with Jenkins composition discs. All parts, including raised seat, are interchangeable and renewable. Guaranteed for working steam pressures up to 150 pounds.

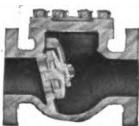


Fig. 339  
Sectional view of  
Iron Body Swing  
Check Valve, Ex-  
tra Heavy Pat-  
tern

### JENKINS BROS. EXTRA HEAVY VALVES

Jenkins Bros. Extra Heavy Valves are designed for 250 pounds working pressure. The Globe, Angle and "Y" or Blow-off Valves are made in brass, either screwed or flanged, sizes  $\frac{1}{4}$  to 3 inches, and iron body 2 to 12 inches inclusive. The valves are well designed, made of the very best steam metals, and great care is taken with the workmanship. The spindles are large and have powerful Acme standard threads. The stuffing boxes are also large and arranged so that they can be packed under full pressure when wide open. They are fitted with renewable steam metal discs when used for steam, with Jenkins Discs for cold water service, and also have removable seat rings which can be reground or renewed when necessary.

A full line of Extra Heavy Horizontal, Angle and Swing Check Valves is also made equally heavy in design and can be recommended as being fully adapted to the service required.

As regularly made, all these Extra Heavy Valves are tested to 800 pounds hydraulic pressure. The factor of safety is so high, however, that the test pressure can be increased to double this figure if required and the valves may be safely used on hydraulic or air pressures up to 800 pounds.

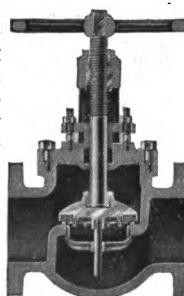


Fig. 102  
Sectional view of  
Iron Body Globe Valve  
Extra Heavy Pattern



## JENKINS BROS.

### JENKINS BROS. EXTRA HEAVY AUTOMATIC EQUALIZING STOP AND CHECK VALVES

are designed to shut off, automatically, the flow of steam from the header to a boiler in case a tube should burst or other internal rupture occur, thereby suddenly reducing the pressure in the boiler. They also serve to equalize the pressure in a battery of boilers and prevent one boiler from working at a lower pressure than the others. As the valves can only be opened by the pressure in the boiler it is impossible to turn steam accidentally into a boiler which is being cleaned. To prevent chattering, the valve is cushioned by an internal dashpot made of bronze which eliminates all danger of sticking through corrosion.

Each valve is carefully tested to 800 pounds hydraulic pressure and is guaranteed for working steam pressures up to 250 pounds. The stuffing-boxes can be packed when valve is wide open under full pressure.

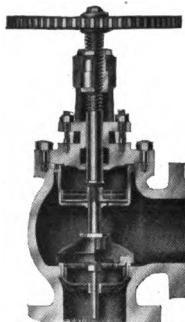


Fig. 293  
Sectional View of Auto-matic Stop and Check Valve, Angle Pattern

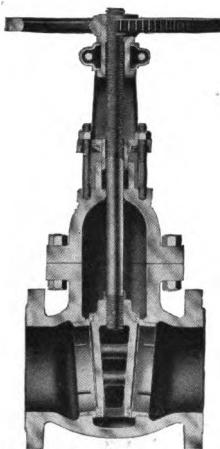


Fig. 245  
Sectional View of Extra Heavy Iron Body Gate with Outside Screw and Yoke

### JENKINS BROS. GATE VALVES

are a comparatively new, and distinctly high grade line. They are made in brass or iron body in three distinct patterns: Standard, for 125 pounds working steam pressure, or 175 pounds water; Medium, for 175 pounds steam or 250 pounds water; Extra Heavy, for 250 pounds steam or 400 pounds water.

They are all of the solid-wedge, double-face type. The wedge or gate is guided by ribs cast on the inside of the body, which fit in corresponding channels in the wedges, thereby preventing the wedge from dragging across the seat, preventing uneven wear on the faces, or chattering when valve is partly open.

One of the important features of these valves is the improved globe shaped body, a novel design which is used because it secures the greatest possible strength, good proportion and neat appearance.

The brass valves are regularly made in sizes  $\frac{1}{4}$  to 3 inches. Larger sizes in brass can be made from iron body patterns.

Standard Iron Body Valves made in sizes 2 to 30 inches; Medium up to 18 inches; Extra Heavy up to 24 inches.

### JENKINS BROS. CAST STEEL VALVES

are made in Globe, Angle, Gate and Check Patterns, which experience has shown are perfectly adapted for the severe conditions incident to high pressure superheated steam service. The steel used in these valves is made in a modern converter from selected irons and for strength, ductility and soundness the castings are fully equal to those produced commercially by any known process.

For seat-rings, discs, bushings, and spindles Monel Metal is used, a natural alloy containing about 70 per cent nickel. The tensile strength is high, it is very hard, durable and non-corrosive and expands and contracts practically the same as cast steel. Seat-rings made of this metal do not get loose under the most severe conditions.

The valves are suitable for working steam pressures up to 350 pounds, and total temperature of 800° F.

All the genuine Jenkins Bros. Valves bear the Diamond Trade Mark, and are absolutely guaranteed to be perfect in workmanship and suitable and efficient in the service for which they are designed.

A catalogue of all the Jenkins Bros. products, giving sizes, styles and list prices mailed on request.

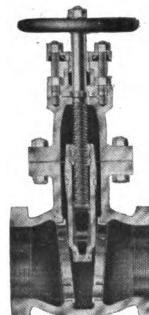


Fig. 250  
Sectional View of Iron Body Gate, Inside Screw

## *Valves*

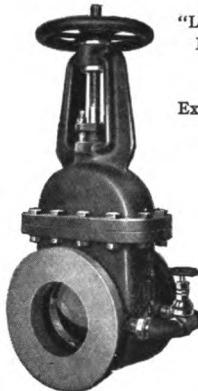
# THE KENNEDY VALVE MFG. CO.

MAIN OFFICE AND WORKS: ELMIRA, N. Y.

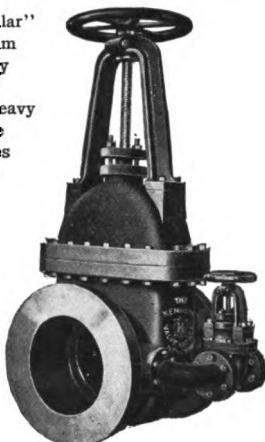
Agencies:  
57 Beekman St., New York City      602 Western Union Bldg., Chicago  
Monadnock Bldg., San Francisco      604 Canal-Louisiana Bank Bldg., New Orleans

**GATE, GLOBE, ANGLE,  
CHECK, RADIATOR AND } VALVES  
INDICATOR**      FOR **{ POWER, HEATING, PLUMBING  
AND AUTOMATIC SPRINKLER  
INSTALLATIONS**

## **FIRE HYDRANTS**



**"Lenticular"**  
Medium  
Heavy  
and  
**Extra Heavy**  
Gate  
Valves

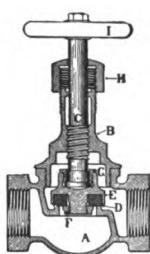


**"Standard"  
Bronze  
Gate  
Valve**



## Indicator Post Valve

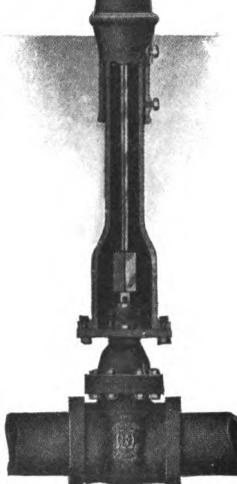
## Globe and Radiator Valves



with  
Goodrich  
Elastic  
Renewable  
Disc



**Swinging  
Check  
Valves**



Write for catalogue "X," describing all the above and many other kinds of valves.

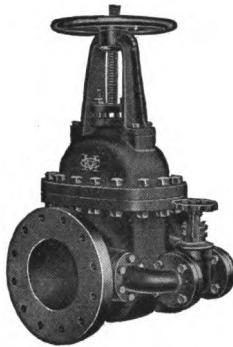
# MONARCH VALVE AND MFG. CO.

SPRINGFIELD, MASS.

NEW YORK    BOSTON    CLEVELAND    PHILADELPHIA

HIGH GRADE VALVES FOR STEAM, WATER, GAS, AIR, OIL, AMMONIA, BRINE, ETC. MADE OF THE BEST STEAM BRONZE, GRAY IRON OR STEEL.

The table below gives a partial list of our regular product.



LIST I		DESCRIPTION				
1	Bronze Gate,	125 lbs. Steam,	250 lbs. Water Pressure.			
2	" " 250 "	" " 400 "	" "			
3	" " 800 "	" " Water Pressure.				
4	" " 2000 "	" " "				
5	" " 6000 "	" " "				
6	Globe, 125 "	Steam, 250 lbs. Water Pressure.				
7	" " 250 "	" " 400 "	" "			
8	" Check, 125 "	" " 250 "	" "	" "		
9	" " 250 "	" " 400 "	" "	" "		
10	" Navy, 50 "	Pressure.				
11	" " 300 "	" "				
12	" " 500 "	" "				
15	Iron Body Gate,	80 lbs. Steam.	150 lbs. Water Pressure.			
16	" " 125 "	" " 200 "	" "			
16½	" " 150 "	" " Pressure.				
17	" " 250 "	" " 400 lbs. Water Pressure.				
18	" " Globe, 125 "	" " 200 "	" "			
19	" " 250 "	" " 400 "	" "	" "		
20	" " Check, 125 "	" " 200 "	" "	" "		
21	" " 250 "	" " 400 "	" "	" "		
22	Steel Gate, 250 "	" " 400 "	" "	" "		
23	" " Globe, 250 "	" " 400 "	" "	" "		
24	" " Check, 250 "	" " 400 "	" "	" "		

## THE MONARCH LOOSE NECK GATE

The cuts below illustrate our method of connecting gate and spindle. The spindle is threaded into a third member, which fits into a slot at the top of gate. There is a slight amount of play between these parts, so that the gate closes without catching or binding, and without uneven wear or side strain on spindle.

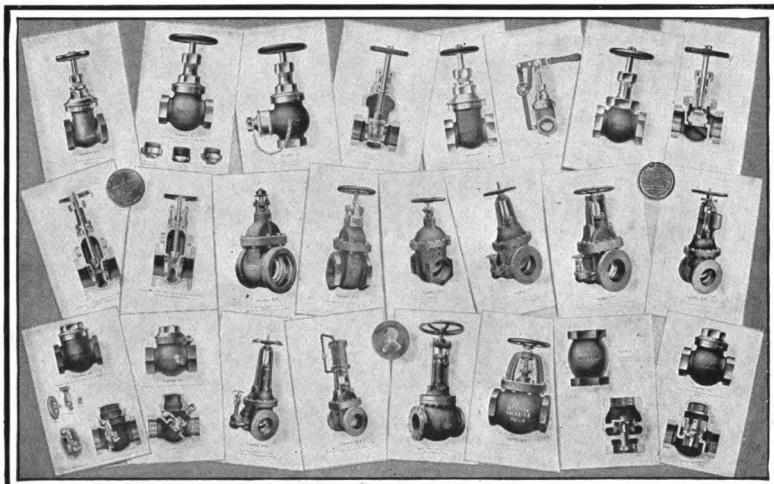


# NELSON VALVE COMPANY

CHESTNUT HILL PHILADELPHIA

Branches in all Principal Cities.

HIGH GRADE BRONZE, IRON AND STEEL VALVES OF EVERY KIND  
FOR EVERY PURPOSE



Part of the Nelson Valve Line

Our undivided attention is given to the manufacture of high grade valves. We make nothing else; we will supply you with any valve you need, any size, for any pressure.

We pay particular attention to steel valves for very high pressure and superheated steam.

## BRIEF LIST OF NELSON VALVES

**Bronze:** Angle and Globe, of all kinds, for all purposes; Gate Valves; Check Valves of every type.

**Iron Body:** Gate Valves; Hydraulically Operated Valves; Electrically Operated Valves; Globe and Angle Valves; Throttle Valves; Cushioned Non-Return Stop and Check Valves; Cushioned Non-Return and Swing Check Valves.

**Steel:** Gate Valves; Globe Valves; Throttle Valves; Cushioned Non-Return Stop and Check Valves; Cushioned Non-Return Valves; Swing Check Valves.

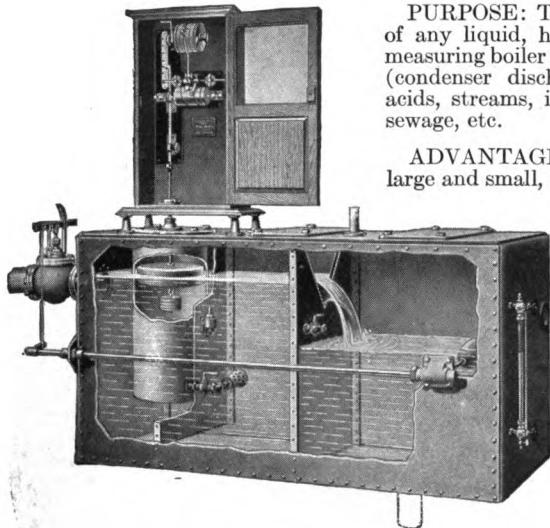
Complete catalog describing *all* NELSON VALVES sent immediately upon request.

# YARNELL-WARING COMPANY

CHESTNUT HILL, PHILADELPHIA

SOLE MANUFACTURERS IN THE UNITED STATES OF THE "LEA"  
V-NOTCH WATER FLOW METER; SIMPLEX SEATLESS BLOW-OFF  
VALVE AND THE SIMPLEX PIPE JOINT CLAMP.

## "LEA" V-NOTCH WATER FLOW METER



PURPOSE: The accurate measurement of any liquid, hot or cold. Is used for measuring boiler feed, steam consumption, (condenser discharge), pump discharge, acids, streams, irrigation ditches, canals, sewage, etc.

ADVANTAGES: At all rates of flow, large and small, the greatest advantage of the "Lea" V-Notch Meter is that it is dependably accurate, as it depends only upon water falling by the simple law of gravity unassisted by any mechanical means, through a V-Notch weir, the quantity of which for each inch of head every engineer knows.

(Thompson's formula—Quantity equals constant  $\times$  H).

Read these other advantages:

- 1st. Records the flow for each moment continuously.
- 2d. No extra storage space for hot water required as flow is continuous.
- 3d. Guaranteed accuracy within 1½%.
- 4th. Equally accurate for maximum or minimum flow.
- 5th. Accuracy unaffected by irregular velocity, temperature changes, dirt, scale or sediment. No moving parts in path of flow to get out of order.
- 6th. No parts of the recording instrument exposed to the flow of liquid being measured.
- 7th. "Lea" Recorder is inexpensive in first cost, has no after-expense for upkeep, and saves more than enough to quickly pay for itself.
- 8th. Your safest guarantee is the success of the "Lea." There are now nearly 600 in use, measuring over half a million engine and boiler horse-power.

Write for bulletin.

## SIMPLEX SEATLESS BLOW-OFF VALVE

Nearly 5000 in Use.

- 1st. Has no seat to leak.
- 2d. Automatically packed.
- 3d. Packing is always protected.

## SIMPLEX PIPE JOINT CLAMP

Over 8000 in Use.

Stops any pipe joint leak immediately.  
Write for complete bulletins about all these.

# THE LUDLOW VALVE MFG. CO.

## TROY, NEW YORK

### BRANCH OFFICES

NEW YORK: 62 Gold St.

BOSTON, MASS.: 182 High St.

PITTSBURGH, PA.: Farmer's Bank Bldg.

CHICAGO, ILL.: 633-635 The Rookery

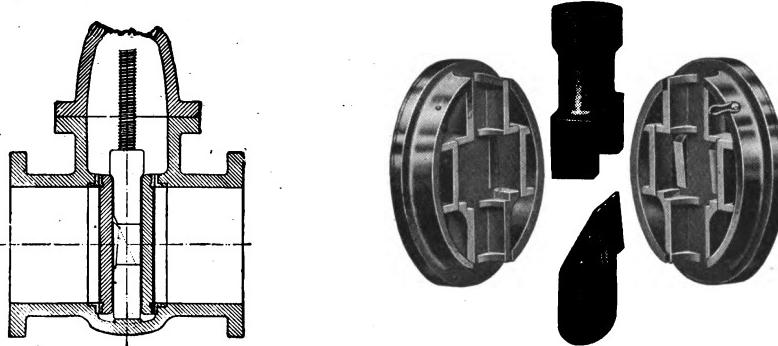
PHILADELPHIA, PA.: Harrison Bldg.

KANSAS CITY, MO.: Victor Bldg.

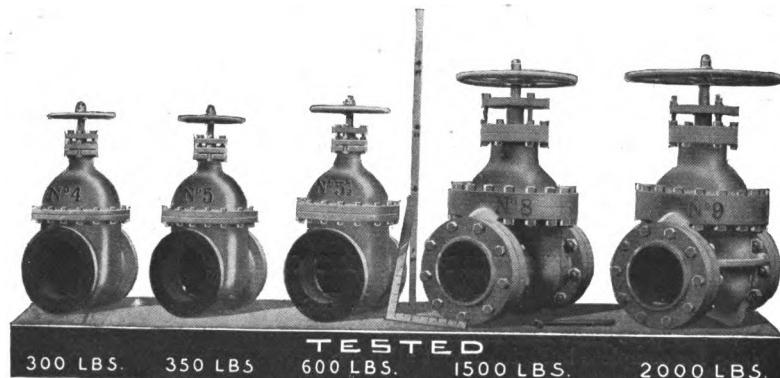
HIGH GRADE VALVES FOR EVERY PURPOSE; VALVES FOR OIL, WATER, STEAM, GAS AND AMMONIA, OF ANY SIZE AND FOR ALL PRESSURES; AUTOMATIC AIR VALVES AND FLOAT VALVES; RELIEF VALVES; SLUICE GATES; CHECK AND FOOT VALVES; COMBINATION AIR VALVE WITH CONTROLLING GATE; HYDRANTS.

### THE LUDLOW DOUBLE GATE VALVE

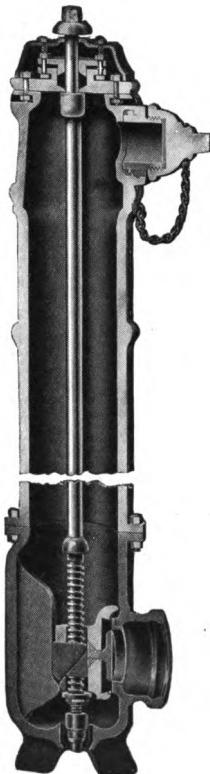
The illustrations below show section of valve and detailed view of the Gates and Wedges. The Gates cannot lock or wedge in closing until directly opposite the ports. Gates are released from seats before starting to rise, avoiding wear on seats, and grinding or dragging of faces of gates on seats is impossible. Stem cannot bind or wedge. The gates cannot cant to either side and cause stripping of threads on stem.



LUDLOW DOUBLE GATE VALVES FOR ALL PRESSURES  
These Valves all have a 10" opening



## THE LUDLOW VALVE MFG. CO.



### FIRE HYDRANTS

Genuine Ludlow Slide Gate, Frost Proof, Fire Hydrant. Rubber-faced Gate. Bronze Mounted.

- (a) Simple in construction.
- (b) Drip valve in extreme bottom of hydrant, draining hydrant barrel completely and permitting no water to remain in same.
- (c) All working parts can be removed without disturbing hydrant barrel or doing any digging.
- (d) Gate is released from seat before starting to rise, avoiding wear on gate rubber.
- (e) Gate when shut remains tight when top of hydrant is removed.
- (f) No flooding of street in case standpipe or barrel is broken.
- (g) In opening hydrant, first turn of the stem closes the drip valve, after which the bronze wedge nut in back of gate is loosened, relieving gate from its seat.
- Final turn of the stem after gate is closed and wedged opens the drip valve.
- (h) Frost case unnecessary.
- (i) Large waterway.

From Page 110 Ludlow Catalogue, 1910

Size of Hydrant or Diameter Valve Opening.....	2"	3"	4"	4½"	5"	6"	8"
Inside diam. of Stand Pipe.....	3"	4½"	5½"	6½"	7"	8"	10"
Size Bottom Connection .....	2"	3" or 4"	4" or 6"	6"	6" or 8"	8" or 10"	
Number and Size Nozzles .....	1-2"	1-2½"	2-2½"	3-2½"	3-2½"	4-2½"	6-2½"

Steamer nozzle can be added on sizes 4" and up, or can be substituted for 2½" nozzles. Inside independent cut-off gate can be furnished on 2½" nozzles if wanted.

# THE LUNKENHEIMER COMPANY

## CINCINNATI, OHIO

BRASS, IRON, SEMI AND CAST STEEL VALVES, WHISTLES, COCKS, GAUGES, INJECTORS, LUBRICATORS, OIL PUMPS, OIL AND GREASE CUPS, MOTOR ACCESSORIES, ETC.

Adapted to the Requirements of All Classes of Machinery.

### LUNKENHEIMER 1912 CATALOGUE

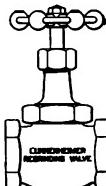


We illustrate on this and the three following pages only a few of our leading specialties, the whole being considerably condensed, owing to the lack of space. For a complete description, with sectional illustrations of the following, together with a large number of other engineering appliances, reference must be had to our 1912 CATALOGUE, a copy of which can be had free of charge.

This book consists of 654 PAGES, is handsomely bound and illustrated, and shows, describes and lists the ENTIRE LINE OF LUNKENHEIMER PRODUCTS, which is not only the LARGEST LINE OF HIGH GRADE ENGINEERING SPECIALTIES IN THE WORLD, but the VARIETY OF THESE APPLIANCES IS BY FAR THE GREATEST.

The LUNKENHEIMER 1912 CATALOGUE also contains tables and information of great value and of daily use to engineers in general,—in fact, it is a book that no engineer can afford to be without. Write for a copy.

### LUNKENHEIMER REGRINDING VALVES BRASS



Made in Globe, Angle and Cross Patterns; Screw or Flange Ends; Medium weight, for working pressures up to 200 pounds, Extra Heavy for 300 pounds; sizes ranging from  $\frac{1}{8}$  to 4 inches inclusive.

These valves can be reground quite a number of times, without removing them from their connecting pipes, making them as tight as when new. The discs and all other parts are renewable; the stuffing-boxes can be repacked under pressure when the valves are wide open; the areas through the bodies are in excess of the nominal inside diameter of the connecting pipes, and the union connection between the body and hub provides a non-corrosive, re-inforcing joint.

### LEADING DIMENSIONS

Size of Valve.....inches	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4
Face to Face Screw End Globe Valve { Medium, "	1 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$	8	9
{ Ex. Hy.. "	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$	5 $\frac{1}{2}$	7 $\frac{1}{2}$	7 $\frac{1}{2}$	10 $\frac{1}{2}$	
Face to Face Screw End { Medium, " Angle or Cross Valves { Ex. Hy., "	$\frac{1}{2}$	1	1	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$
Face to Face Flange End { Medium, " Globe valve..... { Ex. Hy., "	2 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$	8 $\frac{1}{2}$	9 $\frac{1}{2}$	10 $\frac{1}{2}$
Center to Face Flange { Medium, " End Angle or Cross Valve..... { Ex. Hy., "	1 $\frac{1}{2}$	1 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{1}{2}$	5	5 $\frac{1}{2}$	
Center of Port to Top of { Medium, " Stem, when open..... { Ex. Hy., "	2 $\frac{1}{2}$	4	4	4 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	8 $\frac{1}{2}$	9 $\frac{1}{2}$	10 $\frac{1}{2}$	11 $\frac{1}{2}$	12 $\frac{1}{2}$	14
	4 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$	9 $\frac{1}{2}$						

# THE LUNKENHEIMER COMPANY

## LUNKENHEIMER BRASS "RENEWO" VALVES



Globe, Angle and Cross Patterns; Screw or Flange Ends; Medium weight, for working pressures up to 200 pounds, Extra Heavy for 300 pounds; sizes from  $\frac{1}{4}$  to 3 inches inclusive.

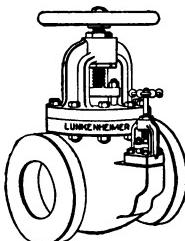
All parts are renewable, including the seat and disc, and the seating faces are also regrindable. Both seat and disc are made of a most durable nickel alloy, and their unique construction reduces the wear on the seating faces, caused by the great velocity of the steam flowing through the valve, makes them self-cleansing and eliminates water-hammer.

Areas through the bodies are larger than those of the connecting pipes; stuffing-boxes can be packed under pressure when the valves are wide open, and the valves are provided with a non-corrosive union connection between the body and hub.

### LEADING DIMENSIONS

Size of valve . . . . .	inches	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3
Face to Face Screw End	Medium, inches	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{3}{4}$	$4\frac{1}{4}$	$4\frac{3}{4}$	$5\frac{1}{4}$	$6\frac{1}{4}$
Globe Valves.....	Ex Hy., inches	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{4}$	$6\frac{1}{2}$	$7\frac{1}{2}$
Center of Port to Face of	Medium, inches	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$
Screw End Angle Valves	Ex Hy., inches	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$3$	$3\frac{1}{2}$	$4\frac{1}{2}$
Center of Port to Face of	Medium, inches	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$
Screw End Cross Valves	Ex Hy., inches	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$
Face to Face Flange End	Medium, inches	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{1}{2}$	$8$	$9$
Globe Valves.....	Ex Hy., inches	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$8$	$9$	$10$
Center of Port to Face of	Medium, inches	...	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$
Flange End Angle or	Cross Valves.....	Ex Hy., inches	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$4$	$4\frac{1}{2}$	$5$
Center of Port to Top of	Medium, inches	$3\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$7$	$7\frac{1}{2}$	$8\frac{1}{2}$	$9\frac{1}{2}$	$10\frac{1}{2}$
Stem, when open .....	Ex. Hy., inches	4%	4%	$4\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{1}{2}$	$8\frac{1}{2}$	$9\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$

## LUNKENHEIMER IRON BODY BRASS MOUNTED GLOBE, ANGLE AND CROSS VALVES



Medium Pattern, for working pressures up to 125 pounds, Heavy for 175 pounds and Extra Heavy for 250 pounds; Screw or Flange Ends. Extra Heavy Pattern can be had with or without interior or exterior by-pass. Medium and Heavy Patterns made in sizes from 2 to 12 inches inclusive; Extra Heavy without by-pass, from 2 to 10 inches, and with by-pass, from  $3\frac{1}{2}$  to 12 inches inclusive.

All parts subjected to wear are renewable; the seating faces of both the main and by-pass valves are regrindable, and the stuffing-boxes can be packed under pressure when valves are wide open.

For superheated steam, these valves can be had made of "Puddled" Semi-steel, a material having a tensile strength of 35,000 pounds per square inch; and for extreme conditions of pressure, superheat and strain, of cast Steel, the tensile strength of which is about 80,000 pounds per square inch.

### LEADING DIMENSIONS

Size of Valve . . . . .	inches	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	6	7	8	10	12
Face to Face Screw End	Med & Hy., in.	$6\frac{1}{2}$	$7\frac{1}{2}$	$8\frac{1}{2}$	9	10	$11\frac{1}{4}$	12	$13\frac{1}{2}$	$15\frac{1}{2}$	18	$23\frac{1}{4}$	27
Globe Valves.....	Ex Hy., inches	$8\frac{1}{2}$	$10\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$	13	14	$14\frac{1}{2}$	$16\frac{1}{2}$	$18\frac{1}{2}$	20	$23\frac{1}{4}$	$27\frac{1}{4}$
Center of Port to													
Face of Screw End	Med & Hy., in.	$3\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	5	$5\frac{1}{2}$	6	$6\frac{1}{2}$	$7\frac{1}{2}$	$8\frac{1}{2}$	10	$11\frac{1}{2}$
End Angle or	Ex Hy., inches	$4\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	7	$7\frac{1}{2}$	$8\frac{1}{2}$	$9\frac{1}{2}$	10	$11\frac{1}{2}$	$13\frac{1}{2}$
Cross Valves.....													
Face to Face of	Medium, inches	$7\frac{1}{2}$	$8\frac{1}{2}$	$9\frac{1}{2}$	$10\frac{1}{4}$	11	12	$12\frac{1}{2}$	$14\frac{1}{2}$	$16\frac{1}{2}$	$19\frac{1}{2}$	$24\frac{1}{2}$	$27\frac{1}{2}$
Flange End	Heavy, inches	8	$9\frac{1}{2}$	10	11	$11\frac{1}{2}$	$12\frac{1}{2}$	$13\frac{1}{2}$	15	17	$20\frac{1}{2}$	$24\frac{1}{2}$	$27\frac{1}{2}$
Globe Valves.....	Ex. Hy., inches	$9\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$	$13\frac{1}{2}$	14	15	$15\frac{1}{2}$	$17\frac{1}{2}$	$19\frac{1}{2}$	$21\frac{1}{2}$	$25\frac{1}{2}$	$28\frac{1}{2}$
Center to Face of	Medium, inches	$3\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$	6	$6\frac{1}{2}$	$7\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	12
Flange End	Heavy, inches	$4\frac{1}{2}$	5	$5\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{1}{2}$	$8\frac{1}{2}$	$9\frac{1}{2}$	$9\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$
Angle or Cross	Ex. Hy., inches	$4\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	7	$7\frac{1}{2}$	$7\frac{1}{2}$	$8\frac{1}{2}$	$9\frac{1}{2}$	$10\frac{1}{2}$	$12\frac{1}{4}$	14
Valves.....													
Center of Port to	Medium, inches	$9\frac{1}{2}$	$10\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$	$14\frac{1}{2}$	$15\frac{1}{2}$	17	$18\frac{1}{2}$	$20\frac{1}{2}$	$22\frac{1}{2}$	$26\frac{1}{2}$	$30\frac{1}{2}$
Top of Stem,	Heavy, inches	$9\frac{1}{2}$	$10\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$	$13\frac{1}{2}$	$14\frac{1}{2}$	$15\frac{1}{2}$	17	$18\frac{1}{2}$	$20\frac{1}{2}$	$22\frac{1}{2}$	$26\frac{1}{2}$
when open.....	Ex. Hy., inches	13	14	16	17	$19\frac{1}{2}$	$20\frac{1}{2}$	22	24	$27\frac{1}{2}$	$29\frac{1}{2}$	$35\frac{1}{2}$	$40\frac{1}{2}$
Center of Valve to End of	By-pass, Extra Heavy Pattern.....	....	....	....	....	7	7	8	9	10	11	13	16
By-pass, Extra Heavy Pattern.....	....	....	....	....	....	7	7	8	9	10	11	13	17

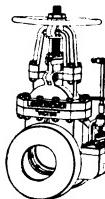
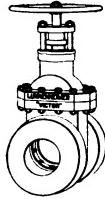
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# THE LUNKENHEIMER COMPANY

CINCINNATI, OHIO

## LUNKENHEIMER IRON BODY BRASS MOUNTED "VICTOR" GATE VALVES



Made with either stationary stem inside screw, or rising stem and yoke; with or without by-pass, screw or flange ends.

Standard Pattern, sizes 2 to 24 inches. From 2 to 8 inches inclusive for working pressures below 125 pounds; above 8 inches for pressures up to 100 pounds. Medium Pattern for working pressures up to 125 pounds; without by-pass in sizes 2 to 24 inches; with by-pass, 5 to 24 inches. Heavy Pattern for 175 pounds working pressure; without by-pass, sizes 2 to 24 inches; with by-pass, 5 to 24 inches. Extra Heavy Pattern for pressures up to 250 pounds; without by-pass, sizes 1½ to 16 inches; with by-pass, 5 to 16 inches.

All parts subjected to wear are renewable, and this includes the seats and discs. The valves are double-seated and will therefore take pressure from either end; both the main and by-pass valves can be packed under pressure when the valves are wide open, and the by-pass seating faces can be reground.

For superheated steam, the "Victor" Gate Valves are made of "Puddled" Semi-steel, and for extreme conditions of pressure, superheat and strain, they are made of Cast Steel.

### LEADING DIMENSIONS

Size of Valve.....inches	1½	2	2½	3	3½	4	4½	5	6	7	8
Face to Face Screw Ends	Standard	4	4½	4¾	5¾	6½	6½	6¾	7½	7½	8¼
	Med & Hy	4½	5¾	5¾	5¾	6	6¾	7¾	7¾	8¾	9¾
	Ex Heavy	4¾	6	6	7¾	7¾	8¾	8¾	9¾	11¾	12¾
Face to Face Flange Ends	Standard	5	5½	5¾	6½	7½	7½	7¾	8¾	9½	9¾
	Medium	5½	5¾	6½	6½	7½	7½	7¾	8¾	10½	11¾
	Heavy	6½	7½	8½	8½	9	9½	10½	10½	12½	13½
Center of Port to Top of Stem, Stationary Stem Pattern	Standard	9¾	11¾	13½	14½	15½	16½	18½	20½	22½	25½
	Med & Hy	10	12½	13¾	14¾	16½	17½	19	21	22½	26
	Ex Heavy	10½	12	13¾	14¾	16½	18	19½	20½	23½	25½
Center of Port to Top of Stem, when open, Rising Stem & Yoke Pattern	Standard	12½	15	16½	19¾	21½	23½	25	30	33½	38½
	Med & Hy	13	15¾	17½	20½	23	24½	27	31½	35	39½
	Ex Heavy	12¾	14½	17	18½	21	23½	25	27½	32½	35½
Center of Body to End of By-pass	Med & Hy	...	...	...	...	...	...	...	6½	7½	8
	Ex Heavy	...	...	...	...	...	...	...	9½	10½	11

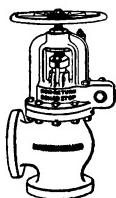
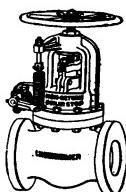
Size of Valve.....inches	9	10	12	14	15	16	18	20	22	24
Face to face Screw Ends	Standard	10½	11¾	...	...	...	...	...	...	...
	Med & Hy	11½	13	14½	...	...	...	...	...	...
	Ex Heavy	13	14½	16	...	...	...	...	...	...
Face to Face Flange Ends	Standard	10½	11¾	13	13½	14	16	17	18	19
	Medium	12½	14½	15	16½	18½	22	24	25	26
	Heavy	14	15½	16½	18	18½	20½	23½	25½	27½
Center of Port to Top of Stem, Stationary Stem Pattern	Standard	19	19½	21½	22½	24	...	...	...	...
	Med & Hy	30	34½	37½	39½	42	46½	50½	54½	59
	Ex Heavy	27½	30	34½	38	39½	42	46½	51½	55
Center of Port to Top of Stem, when open, Rising Stem & Yoke Pattern	Standard	32½	37	40½	42½	45½	...	...	...	...
	Med & Hy	46	54	61½	65½	69½	75½	83½	91	98½
	Ex Heavy	47½	55	62½	66½	71	77½	85½	93	101
Center of Body to End of By-pass	Med & Hy	9½	10½	11½	13½	14½	15	19½	21½	22½
	Ex Heavy	...	14½	15½	17	18	19½	...	...	...

(Continued from preceding pages)

# THE LUNKENHEIMER COMPANY

## CINCINNATI, OHIO

### LUNKENHEIMER NON-RETURN SAFETY BOILER STOP VALVES



Made in sizes from 4 to 10 inches inclusive, screw or flange ends, and in five different combinations of material to suit the requirements of various conditions of superheat and high pressure, and to meet the specifications of engineers who may differ as to what is best suited to the purpose.

Valves will immediately close in case of a sudden decrease in pressure on the boiler side of the disc, caused by the blowing out of a tube in the boiler or any rupture of the headers, shell, etc. Chattering or vibration of the disc is overcome by an ingenious outside spring arrangement. Valves cannot be opened by hand, but can be positively closed.

Of extra heavy construction, well made in every detail, and guaranteed in every particular. All parts subjected to wear are renewable.

#### LEADING DIMENSIONS

Size of Valve.....	inches	4	4½	5	6	7	8	10
Face to Face, Screw End Globe Valve.....	inches	13	14	14½	16½	18½	20	23½
Center to Face, Screw End Angle Valve.....	inches	6½	7	7½	8½	9½	10	11½
Face to Face, Flange End Globe Valve.....	inches	14	15	15½	17½	19½	21½	25½
Center to Face, Flange End Angle Valve.....	inches	7	7½	7½	8½	9½	10½	12½
Center of Body to {Globe Valve.....	inches	21½	23	25	27	31½	33½	40½
Top of Stem, open..... {Angle Valve.....	inches	21	22½	24½	27	31	33	39½
Center of Body to Extreme End of Yoke.....	inches	9	9½	9½	11	12½	14	16½

### LUNKENHEIMER "PUDDLED" SEMI-STEEL VALVES

Particularly adapted for high pressures and superheated steam.

The "Puddled" Semi-steel as used in Lunkenheimer valves is an extremely high-grade iron and steel alloy of very close grain and great strength, the tensile strength per square inch being about 35,000 pounds.

All parts subjected to wear are renewable, making the valves practically indestructible.

The line includes Globe, Angle, Cross, Gate, Check and Non-return Safety Boiler Stop Valves, guaranteed for working pressures up to 250 pounds per square inch, and to suit various conditions of superheat and meet the specifications of engineers who differ as to the material used for the trimmings, "Lunkenheimer "Puddled" Semi-steel Valves are made in two combinations.

### LUNKENHEIMER CAST STEEL VALVES

For extreme conditions of pressure, superheat and strain, Lunkenheimer Cast Steel Valves are unexcelled.

They are the only cast steel valves that meet the specifications of the American Society for Testing Materials.

The tensile strength of Lunkenheimer Cast Steel is about 80,000 pounds per square inch, with a safe elastic limit and excellent elongation.

To suit the requirements of various conditions of superheat and high pressure, and also to meet the specifications of engineers who may differ as to what is best suited to the purpose, Lunkenheimer Cast Steel Valves are made in two combinations as regards the material used for the trimmings.

The line includes Globe, Angle, Gate, Non-return Boiler Stop Valves, etc.

# PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.

PITTSBURGH, PA.

## ENGINEERS, MANUFACTURERS AND ERECTORS

Designers and Builders of Valves, Fittings and Appliances of Every Description for Steam, Gas, Water, Air and Hydraulic Piping.

Designs and Estimates for special valves and equipment furnished upon receipt of specifications.



Atwood Horizontal  
Separator



Outside Dashpot  
Non Return Valve



48" Double Spindle  
Gate Valve



120" Butterfly Valve

- Hand Operated Gate Valves.
- Electrically Operated Gate Valves.
- Cylinder Operated Gate Valves.
- Quick Opening Gate Valves.
- Globe, Angle and Cross Valves.
- Check Valves.
- Butterfly Valves.
- Critchlow Operating Valves.
- Tanner Operating Valves.
- Aiken Operating Valves.
- Relief Valves.
- Back Pressure Valves.
- Non Return Valves.
- Throttle Valves.
- Transfer Valves.
- Register Valves.
- Float Valves.
- Foot Valves with Strainers.
- Blow Off Valves.
- Plug Valves.
- Hydraulic Cocks.
- Tuyere Cocks.
- Hydraulic Spring Cushions.
- Gas Line Materials.
- Pressure Regulating Stations.
- Cast Iron Pipe.
- Pipe Fittings and Flanges.
- Pipe Bends.
- Expansion Joints.
- Exhaust Heads.
- Steam Separators.
- Drip Pockets.
- Strainers.

# PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.

PITTSBURGH, PA.

## GATE VALVES

### SPECIFICATIONS FOR MATERIAL

Grey Iron—22,000 lb. per sq. in. tensile strength.

Semi Steel—33,000 lb. per sq. in. tensile strength.

### PARALLEL SEAT

50 lb. WORKING PRESSURE

100 lb. TEST PRESSURE

### PARALLEL SEAT

125 lb. WORKING PRESSURE

300 lb. TEST PRESSURE

### PARALLEL SEAT

200 lb. WORKING PRESSURE

400 lb. TEST PRESSURE

### PARALLEL SEAT

400 lb. WORKING PRESSURE

800 lb. TEST PRESSURE

### PARALLEL SEAT

500 lb. WORKING PRESSURE

1500 lb. TEST PRESSURE

### PARALLEL SEAT

1000 lb. WORKING PRESSURE

1500 lb. TEST PRESSURE

### PARALLEL SEAT

1500 lb. WORKING PRESSURE

2000 lb. TEST PRESSURE

### TAPER SEAT

175 lb. WORKING PRESSURE

500 lb. TEST PRESSURE

### TAPER SEAT

250 lb. WORKING PRESSURE

800 lb. TEST PRESSURE

### TAPER SEAT

1000 lb. WORKING PRESSURE

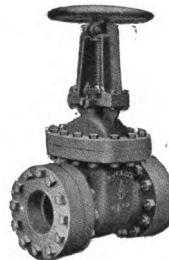
2000 lb. TEST PRESSURE

### GATE VALVES FOR ANY PRESSURE

## GATE VALVES



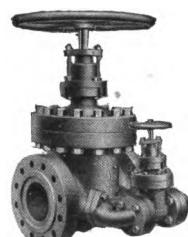
50 lb. Parallel Seat Gate Valve. Close Pattern



8" 500 lb. Gate Valve



4" 1000 lb. Gas Line Gate Valve



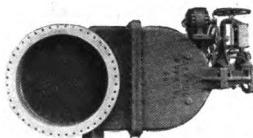
8" 1000 lb. Hydraulic Gate Valve

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## PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.

PITTSBURGH, PA.

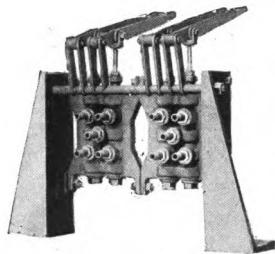


48" Motor Operated Gate Valve



30" Gate Valve Operated by Air Cylinder

Any of the foregoing gate valves may be equipped with operating cylinders for any service or pressure, or motors for either direct or alternating current.



Group of Two Critchlow Nests



Tanner Valve with Actuating Cylinder

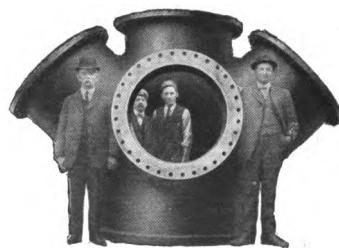
The following types of operating valves are extensively used for the control of motion of hydraulic cylinders, either single or double acting.

The **CRITCHLOW VALVE** is the simplest form of hydraulic three or four way piston valve and has no superior for working pressures up to 500 pounds. It is durable and easy to repack. The CRITCHLOW NEST furnishes a means of grouping these valves which yields a great saving in pipe, fittings, manifolds and space, where a number of cylinders are to be operated from one pulpit.

The **TANNER VALVE** is more satisfactory than the Critchlow on high pressures. It is of the cup-packed piston type, so designed that the fluid forces the packing away from the ports instead of into them, prolonging the life of the packing and making operation easy. The arrangement of supply and waste ports facilitates attaching to manifolds. Larger sizes can be furnished with actuating cylinder permitting remote control by means of a pilot valve.

The **AIKEN VALVE** has given complete satisfaction to a large number of users for many years. The designs and patterns for this valve have been purchased from the inventor, Henry Aiken, M.E., and valves can be made to meet any requirements.

Special facilities for casting and machining large pipe and fittings as well as all classes of work such as furnace castings, general castings, etc.



60" x 42" x 42" x 42" Special Cross with 30" Side Outlet

# PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.

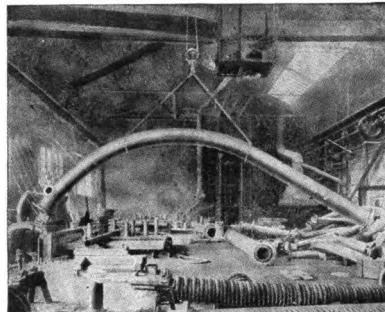
PITTSBURGH, PA.

## PIPING SYSTEMS

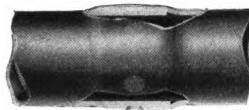
For all Pressures and Purposes,  
Designed, Manufactured  
and Installed

Pipe Bending      Pipe Cutting  
Pipe Fitting

Estimates furnished on receipt  
of specifications



20" Expansion Bend—Radius 16 Ft.  
This bend contains 38 ft. of pipe and was made  
of two lengths joined in the arc by  
the Atwood Line Weld



The Atwood Line Weld  
Patented



The Interlock Welded Neck  
Patented



The Atwood Joint

## THE ATWOOD LINE WELD

This method of joining the abutting ends of wrought pipe allows the fabrication of pipes into lengths as long as can be handled for shipment with consequent reduction by about 50 per cent of the number of flanged joints in the line.

## INTERLOCK WELDED NECKS

This method of connecting branch lines of wrought pipe to mains of the same material was developed in response to the demand of steam users for a structure containing the minimum number of joints. Every branch so connected eliminates a cast fitting with its attendant joints, gaskets and bolts and liability to trouble therefrom.

## FLANGED JOINTS

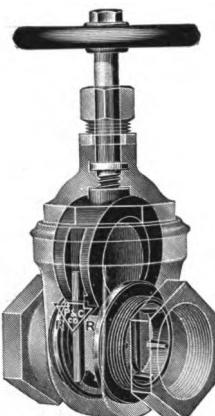
Atwood, Screwed, Shrunk, Expanded and Welded.



# THE PRATT AND CADY COMPANY

HARTFORD, CONN.

## VALVES FOR ALL PURPOSES



### GATE VALVES

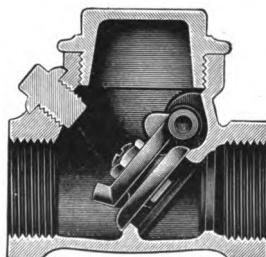
With renewable seat rings, held in place by a retaining ring that is easily removed.

Screw Hub, Stationary Spindle, Retaining Ring Construction.

The seat rings are independent rings of bronze, or any special metal or material best adapted for the service in which the valve is to be used. The gate is a double faced, wedge shaped casting, with side grooves by means of which it slides on guides in the valve body.

Great pains are taken in the machining of all parts of these gate valves. Gauges are used on each part to insure their accuracy and interchangeability.

The guides in our bodies are of equal thickness, and the wedge can be taken out of the valve and replaced with the opposite faces in contact, and will give an accurate fit. The importance of this in making repairs is obvious. These valves being double seated, can be used with the pressure applied at either end.

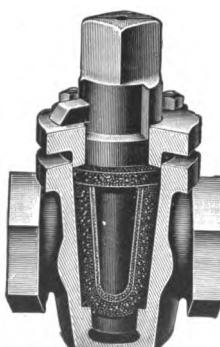


### REGRINDING SWING CHECK VALVES

Brass and Iron

All styles for all pressures, sizes up to 48 inches.

The *Design* combines pressure resistance with easy flow lines. Material (of brass valves) is 86% pure copper. We use no scrap in their production. *Workmanship*—Each valve is individually tested to the pressure stated in catalog. All seats are carefully ground. Assembling is done by our most careful hands. The *Interior Construction* permits the replacement of any working part without removing valve from line. *For Regrinding* no tool is necessary but a wrench and brace and bit.



### ASBESTOS-PACKED COCKS

The dovetailed U-shaped grooves in the body are packed with prepared asbestos. An asbestos ring is used on the shoulder of the plug for top packing.

The plug is of standard taper carefully finished and barbied to render it rustless. It has no metallic bearing, coming in contact only with asbestos, the elasticity of which compensates for the differential expansion and contraction of the plug and body. The gland admits of adjustment by means of its bolts.

These cocks give exceedingly satisfactory results as a boiler blow-off and a water column blow-off, between check and boiler, between water column and boiler, and they do work where ground plug cocks are unsatisfactory and where Globe, Angle or Gate Valves fail.

**THE PRATT AND CADY COMPANY**  
**HARTFORD, CONN.**  
**VALVES FOR ALL PURPOSES**

**ASBESTOS DISC VALVES**

The Stuffing Box Gland is long, heavy and well fitted.

The Spindle Collar, and its point of contact with the bonnet, have specially smooth surfaces and make a steam-tight joint when valve is fully open.

The Disc Holder is guided by four splines in the body, assuring perfect alignment at all times. The Disc Holder is of the horseshoe type, and can be removed and replaced, the only tool necessary therefor being a wrench to unscrew the bonnet.

The Seat is spherical, thus preventing the settling thereon of any substance that might hold the disc from going squarely to its place. The metal used in the construction of these valves is approximately 86% pure copper. We use no scrap whatever in the construction.

The Valve complete is finished with the utmost care. When so ordered, these valves can be made with solid brass disc, or with brass disc holder filled with special metal, at additional price.

**CAST STEEL GATE VALVES FOR SUPER-HEATED STEAM**

All Valves 2½" and larger are equipped with Cast Steel Bodies, Bonnets and Wedges.

The Seats and Faces of the Wedges are made of Pure Nickel, securely fastened in place so that they will be unable to work loose.

Stems are Nickel Steel.

All Bolt Holes are Spot Faced.

Bonnet Joint is packed with "Palmetto" Superheat Packing.

The End Flanges have  $\frac{1}{8}$ " Raised Faces, extending full width inside of Bolt Holes, with smooth finish.

All Bolts have Hexagon Heads and Nuts, with the under side of same semi-finished.

The Discs are of the Wedge Pattern.

Stuffing Box is made with Hinge Bolts, very deep for square "Palmetto" Packing.

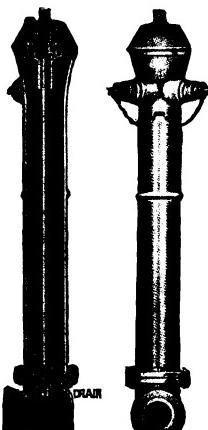
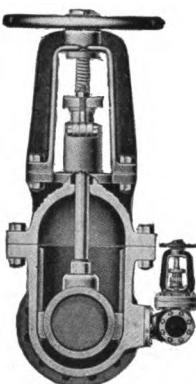
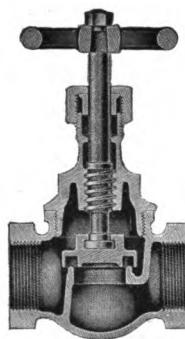
Yoke is bolted to the Bonnet.

All tested to a hydrostatic pressure of 800 lbs..

**COMPRESSION TYPE HYDRANTS**

Without Intricacy of Construction.

Complete catalog of all Pratt and Cady products on request.



## *Rotary Gate Valves*

# JOHN SIMMONS COMPANY

104-110 CENTRE STREET, NEW YORK, N. Y.

IRON PIPE, FITTINGS AND VALVES

### ROTHCHILD ROTARY GATE VALVES

The severe conditions governing the successful operation of the high-pressure steam plant of today demand valves that will operate *quickly* and *positively* will not *leak* or *stick* and will stand up under the hardest strains.

That's where the Rothchild Rotary Gate Valve comes in!

It is a *Hard Service Valve* any way you take it, especially as a boiler Blow-off. It is so radically different from other valves that it is in a class all by itself. Take a good look at the accompanying cut and see for yourself.

First of all note the simplicity—The gates are entirely surrounded by uniform pressure and automatically take up their own wear by *pressure alone*—making a perfect seat that simply *cannot leak or stick*.

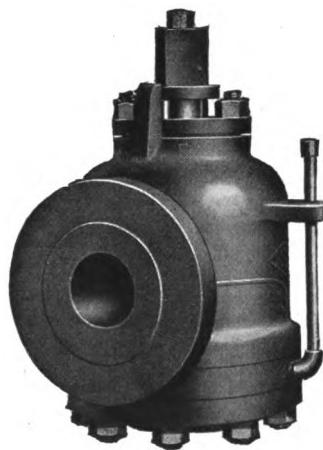
There is no undue strain on the seating parts and the gates are held in the best position when fully open or closed, by positive stops—in view of the operator.

There are *many* other good points about the Rothchild that we will not attempt to tell here. Let us send you our booklet describing it in detail. Equally good for Steam, Water, Ammonia, Gas, Air, Oil or other Fluids. Hot or Cold.

Send for our general catalogue, showing full line of pipe, fittings, tools, valves and specialties for the steam and plumbing supply.

### DIMENSIONS AND WEIGHTS OF ROTHCHILD ROTARY GATE VALVES

SIZE	FACE OF INLET TO CENTRE OF VALVE	FACE OF OUTLET TO CENTRE OF VALVE	WEIGHT
1 $\frac{1}{4}$ inch	2 $\frac{1}{2}$ inch	2 $\frac{1}{2}$ inch	6 $\frac{1}{4}$ lbs.
1 $\frac{1}{2}$ "	2 $\frac{5}{8}$ "	2 $\frac{5}{8}$ "	12 $\frac{1}{4}$ "
2 "	3 $\frac{1}{8}$ "	3 $\frac{1}{8}$ "	23 "
2 $\frac{1}{2}$ "	5 $\frac{3}{4}$ "	4 $\frac{1}{8}$ "	83 $\frac{3}{4}$ "
3 "	6 $\frac{1}{4}$ "	4 $\frac{7}{8}$ "	123 "



External View

# WALWORTH MANUFACTURING CO.

Established 1842

132 FEDERAL ST., BOSTON, MASS.

Works, South Boston.

New York Office, Park Row Building.

Manufacturers of

## HEAVY PRESSURE POWER PLANT PIPING MATERIALS

The WALWORTH up-to-date Catalog to be issued in 1912 will give full details, with illustrations, dimension Tables, etc., and will be furnished on request to interested parties.  
Write Department E.

The following will give you a general idea of our complete line—furnished both STANDARD and EXTRA HEAVY:—

WALMANCO FLANGED-OVER THREADLESS PIPE JOINTS, swivel ends for 250 pounds working pressure.

WALWORTH LONG SWEEP FLANGED AND SCREWED FITTINGS.

WALWORTH WROUGHT IRON OR STEEL PIPE BENDS, with threaded or Walmanco Joints.

WALWORTH ELBOWS, TEES, CROSSES, FLANGES, etc. (Brass and Iron), for all pressures.

“WALCO” MALLEABLE IRON BRASS SEAT UNIONS, ground joint.

FLANGES, Standard and Extra Heavy.

WROUGHT IRON PIPE WITH WELDED FLANGES.

STEEL PIPE DRUMS, with welded pipe nozzles riveted on, using Walmanco or welded flanges.

CAST IRON FLANGED PIPES.

CAST IRON BRACKETS, ROLLER CHAIRS AND FLOOR STANDS.

QUICK CLOSING SAFETY DEVICE FOR WATER GAUGE COLUMNS.

INJECTORS AND POP SAFETY VALVES.

ENGINE AND BOILER TRIMMINGS, WATER GAUGES, etc.

### WALWORTH HIGH-GRADE GATE VALVES,

With Renewable Bronze Seats. Outside Screw and Yoke or Stationary Spindle. Spindles either Bronze or Steel. Can be repacked under pressure. Sizes up to 42 inches diameter.

STANDARD IRON BODY BRASS MOUNTED GATE VALVES for 125 pounds working pressure.

MEDIUM IRON BODY BRASS MOUNTED GATE VALVES for 175 pounds working pressure.

EXTRA HEAVY IRON BODY BRASS MOUNTED GATE VALVES for 250 pounds working pressure.

HYDRAULIC BRASS MOUNTED GATE VALVES, for 800 pounds working pressure.

BRASS GATE VALVES, standard and Extra Heavy.

“WALCO” BRASS GATE VALVES, for 125 pounds working pressure, STANDARD AND EXTRA HEAVY IRON BODY GLOBE AND ANGLE VALVES,

Never-Stick Boiler Blow-off Cocks,

AUTOMATIC STOP VALVES, extra heavy.

For Heavy Pressure Piping we furnish:

WALWORTH SEMI-STEEL CASTINGS

For Drums, Valves and Fittings

(Average Tensile Strength, 33,500 Pounds)

We also manufacture a complete line of Pipe Fitters' Tools, Stocks and Dies, Pipe Cutters, Vises, etc., including the—



GENUINE STILLSON WRENCH  
which bears the Diamond Trade Mark.



## ARMSTRONG CORK COMPANY INSULATION DEPARTMENT

1422 UNION BANK BUILDING, PITTSBURGH, PA.

Branch Offices in the Large Cities

**NONPAREIL HIGH PRESSURE COVERING** for steam lines, boilers and all heated surfaces; **NONPAREIL CORK COVERING** for brine, ammonia and ice water lines; **NONPAREIL CORK BOARD INSULATION** for cold storage plants. **CONTRACTORS** for heat and cold insulation

### **NONPAREIL HIGH PRESSURE COVERING**

The heat-insulating efficiency of diatomaceous earth has long been recognized, but, until recently, no satisfactory process was available by which it could be bonded together in sectional form so as to produce a strong, efficient covering for high pressure and superheated steam lines. After years of research this problem was solved successfully and Nonpareil High Pressure Covering is the result.

The peculiar porous structure of diatomaceous earth makes Nonpareil Covering a better nonconductor of heat than any of the coverings now in general use. Moreover, it will withstand temperatures at which other coverings calcine and disintegrate, is unaffected by moisture or steam, is easy to apply and reasonable in price. Tests demonstrating the truth of these assertions are fully described in our catalogue.

Nonpareil Covering is made in sectional, block and cement form. While comparatively new, it has already been installed in several hundred plants throughout the country and is giving universal satisfaction. Write for catalogue and sample.

### **NONPAREIL CORK COVERING**

Nonpareil Cork Covering for brine, ammonia and ice water lines is composed of granulated cork slightly compressed and molded in sectional form to fit the different sizes of pipe and various fittings in ordinary use. It is coated inside and out with a mineral rubber finish and is applied with waterproof cement on the joints, rendering them impervious to moisture. Nonpareil Cork Covering possesses great insulating efficiency, is remarkably durable in service, is clean, neat in appearance and easy to apply.

It is manufactured in four thicknesses to meet different service conditions, viz.: 1. *Standard Brine Covering* for temperatures ranging from  $-10^{\circ}$  to  $25^{\circ}$  F. 2. *Special Thick Brine Covering* for temperatures below  $-10^{\circ}$  F. 3. *Ice Water Covering* for temperatures of  $25^{\circ}$  to  $45^{\circ}$  F. 4. *Cold Water Covering* for temperatures above  $45^{\circ}$  F.

Mitred cork lagging, beveled to any desired radius, is furnished for cylindrical tanks, filters, large sized pipes, etc. Catalogue and samples will be cheerfully forwarded, on request.

### **NONPAREIL CORKBOARD INSULATION**

Nonpareil Corkboard is the world's standard cold storage insulation. It is composed of pure granulated cork, made into boards 12 x 36", of various thicknesses. Our bound book, "Nonpareil Corkboard Insulation," fully describing this material will be sent to anyone on request.

## ROBERT A. KEASBEY CO.

100 N. MOORE ST., NEW YORK CITY

PIPE AND BOILER COVERINGS—85% Magnesia; Asbestos, Air-Cell or Moulded; Cork, Wool Felt.

INSULATING MATERIALS for Heat and Cold, Asbestos Cements, Paper and Millboard, Hair Felt, Mineral Wool, etc.

SOLD or APPLIED

PACKINGS OF ALL KINDS—Asbestos, Flax, Cotton, Rubber, Metallic.  
BRAKE BAND LININGS. COLD WATER PAINT.

### MAGNESIA SECTIONAL COVERING

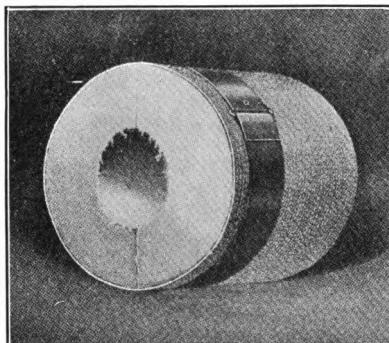
(Containing 85 per cent. Carbonate of Magnesium)

#### KING OF COVERINGS

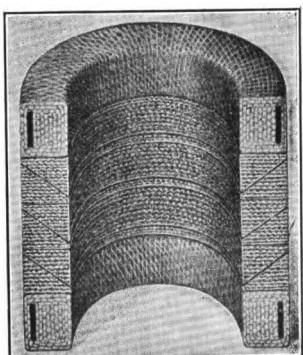
Made in sections three feet long, halved to fit pipe from  $\frac{1}{2}$ " to 10" inclusive, canvas jacketed. Standard thick (approximating 1"), 1 $\frac{1}{2}$ " thick, 2" thick (double standard thick) and double 1 $\frac{1}{2}$ " thick to be used when different results of efficiency are desired.

Also in Cement form (85% Magnesia Plaster) for fittings, irregular shapes, filling spaces, etc.

Also in Blocks (85% Magnesia Blocks) 3" x 18" and 6" x 36" from  $\frac{1}{2}$ " to 4" thick. Catalog of these and all styles furnished upon request.



### "RAKCO" BRAND, ASBESTOS, FLAX, COTTON, AND RUBBER PACKINGS



These packings are manufactured with great care from the highest class of materials to suit all kinds of service.

Special conditions frequently make it advisable to use various combinations of packings. In this event we recommend our Combination sets of Packings, as we have special sets to meet every known condition. These different sets are made to exactly fill the stuffing box, and when ordering same it is necessary that we have diameter of the rod and diameter and depth of box stuffing.

Catalog on request.

### CONTRACTS EXECUTED

Contracts for covering pipe; propositions involving insulation materials, or other work in our line will be handled with the advantages secured by a large stock, and a competent force of men. Correspondence solicited.

# THE NATIONAL AIR CELL COVERING CO.

210-218 VAN BRUNT ST., - - - BROOKLYN, N. Y.

## PYRO-BESTOS SECTIONAL STEAM PIPE COVERING

Pyro-bestos is an improved absolutely water and fire-proof heat-insulating material, and is distinguished from all other heat insulating materials from the fact that while other materials are more or less fire-proof none of them are water-proof.



In the form of a Sectional Removable Pipe Covering its superior fire-proof qualities and resistance to any deterioration from excessive heat marks it as especially adapted for use on all power house work, or *high pressure or super-heated steam piping anywhere*. The high heat temperatures have no effect whatever on the material, whereas on any piping carrying steam at more than 150 lbs. pressure, 85% Carbonate of Magnesia or any other of the Pipe Coverings now in use disintegrates and, becoming a powdery mass, lose their effectiveness as good heat non-conductors.

Owing to its water-proof qualities it is the most suitable Covering for insulating steam piping out of doors, or wherever exposed to the weather, for piping underground or in damp places, also for piping under the floors of piers and docks, etc., as the occasional submersion in water, to which these pipes may be subjected to on account of tides, has no effect on Pyro-bestos.

Pyro-bestos Sectional Pipe Covering is furnished in 3-foot lengths and to fit any size pipe for  $\frac{1}{2}$ " to 30" in diameter. Special Sectional Removable Coverings are furnished for flanges, owing to the necessity of getting at the flanges when desired, but for covering all other fittings we advise the use of our Pyro-bestos Cement Feltting, as owing to the lack of uniform shape and measurements among fittings, it is impossible to make a satisfactory sectional Removable Covering for them.

Pyro-bestos is especially adapted for insulating street mains of Heating Stations or those from a Central Heating Plant.

## PYRO-BESTOS AS A NON-CONDUCTING LINING FOR SMOKE FLUES, BREECHINGS, AND STEEL STACKS

Pyro-bestos as a lining for steel smoke stacks occupies a special field of advantage, as by means of its use Architects are enabled to substitute the lighter weight and less expensive steel stack construction for the brick stack heretofore almost compulsory in its use.

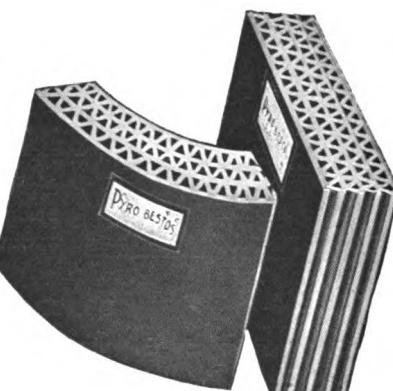
Being fire-proof and water-proof and also, what is most important, absolute proof against the action of the gases of combustion, it not only protects the steel stack against all possibilities of wear, but also by reason of its superior non-conducting efficiency does away with all heat radiating from the stack.

It is easily applied to the interior of the stack by means of bolts and supporting angle iron rings spaced 30" centers.

It has been the practice to erect in some cases steel stacks lined with brick, but in view of the ability to use Pyro-bestos lining in place of brick, the latter can be profitably dispensed with, as Pyro-bestos is not only a much cooler lining but also considerably lighter in weight.

Two inches thick Pyro-bestos lining, including the angle iron rings, weighs but about 30 pounds per square foot, or one-fourth that of a 5" radial brick lining, and as it obstructs in any 6 or 7 foot diameter stack only 10% of the opening as against 30% for brick, a very large saving can be effected in the construction of the stack, as it can be less in diameter to provide proper draught, and of lighter gauge construction and support to carry the weight of the lining.

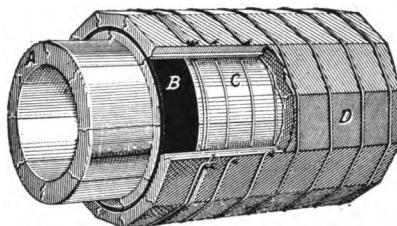
The best material for construction of fire-proof or non-conducting ceilings and partitions.



## A. WYCKOFF & SON CO.

ELMIRA, NEW YORK

MANUFACTURERS OF PATENT WATER PROOF PIPE CASING FOR  
UNDERGROUND OR EXPOSED STEAM LINES.



A—2 Inch Thick Inner Shell.  
C—Dead Air Space.

B—Asphaltum Packing.  
D—1 Inch Thick Outer Shell.

### WYCKOFF'S IMPROVED CYPRESS STEAM CASING. MADE OF GULF CYPRESS, THE WOOD ETERNAL.

Gulf Cypress is used instead of Pine or Tamarack because Gulf Cypress is the only known wood not affected by Wet or Dry Conditions. The outer shell is one inch thick, the inner shell two inches and the dead air space  $\frac{1}{4}$  inch, making the total thickness of the casing  $3\frac{1}{4}$  inches. These improvements will more than double the life of the Wyckoff pipe casing. The asphaltum packing and the driven joint makes the casing absolutely waterproof. This pipe casing is the ONLY ONE on the market with

#### $\frac{1}{4}$ " DEAD AIR SPACE BETWEEN THE SHELLS.

This dead air space between the shells has been increased 50 per cent over the former Wyckoff casing.

*Send for our booklet to-day—it tells you all about these improvements.*

# S. F. BOWSER & COMPANY, Inc.

Established 1885

FORT WAYNE, IND.

New York      Boston      Philadelphia      Chicago      St. Louis  
San Francisco      Minneapolis      Dallas      Atlanta      Toronto      Toronto

## OIL SYSTEM ENGINEERS AND MANUFACTURERS

**Oil System Engineers and Manufacturers of:**

**Oil Distributing Systems.**

**Self-Measuring Hand and Power Driven Pumps.**

**Underground Storage Systems.**

**Large Tankage.**

**Oil Storage Systems.**

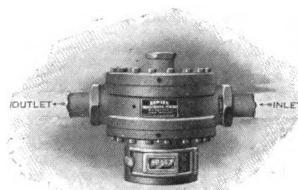
**Automobile Filling Stations.**

**Dry Cleaning Systems.**

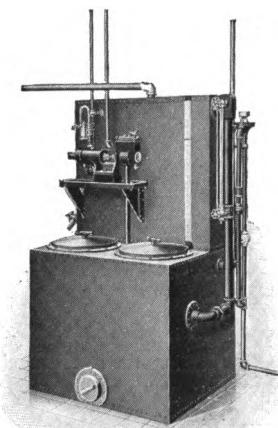
**Self-Registering Pipe Line Measures.**

**Oil and Gasolene Storage Outfits for Public and Private garages.**

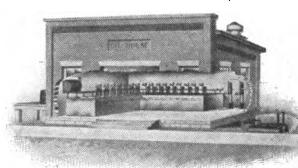
**Oil Filtration and Lubricating Systems.**



Registering Measure



Filtration System



Oil House

The Bowser line covers every requirement of the factory and railroad for oil storage equipment.

Our corps of mechanical and drafting engineers is at the command of those interested in this line.

Bulletins giving complete detailed description of any line will be furnished upon application and without obligation. We have a fund of information on oil storage and allied lines that will assist in making up specification for this work. Let us submit it.

Our catalogue No. 12B illustrates and describes the line in a limited way and shows a large number of installations in widely diversified fields. Write for it.

## GREENE, TWEED & CO.

109 DUANE STREET,

NEW YORK

MANUFACTURERS OF THE  
ROCHESTER AUTOMATIC LUBRICATOR



Vacuum and Check Valve

The Lubricator, in the manufacture of which no expense has been spared, efficiency and high quality being our aim rather than low prices.

For the lubrication of the cylinders of all types of steam engines and pumps as well as air and ammonia compressors.

Made in all sizes from one-half pint to two gallon and with any number of feeds from one to eight. Also made with two compartments, for use where different kinds of oil are used in the different cylinders of the same machine, such as air compressors, ice machines, etc.

Finish-all sizes above one-half pint fully nickel-plated, one-half pint size, japanned body.

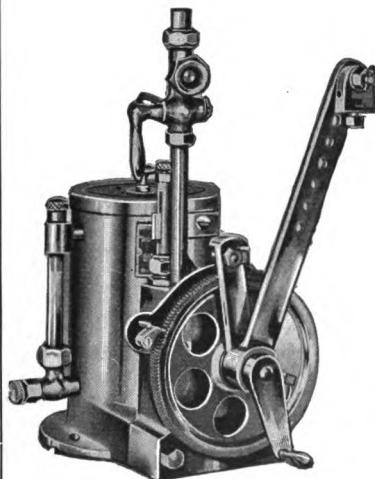
Working parts are made of steel, and all bearings are case hardened.

All the mechanism can be instantly detached and removed, giving easy access to the working parts for cleaning, repairing, etc., without disturbing the bowl or reservoir attached to the engine.

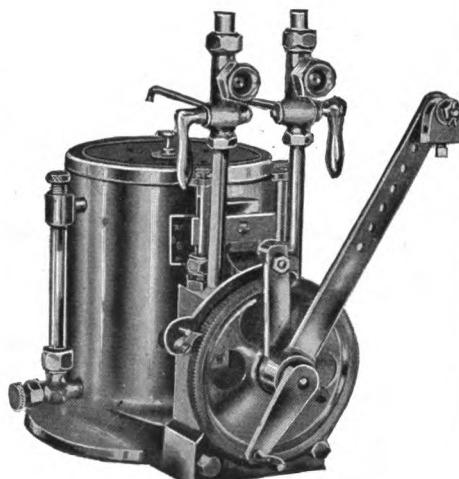
Equipped with Multiplus Sight Feeds, and vacuum and check valves.

Each feed is regulated independently.

Not affected by temperature, pressure or vacuum.



Single Feed



Double Feed

"PERFECT FORCE FEED LUBRICATION"

## HILLS-MCCANNA COMPANY

153 WEST KINZIE ST., CHICAGO, ILL.

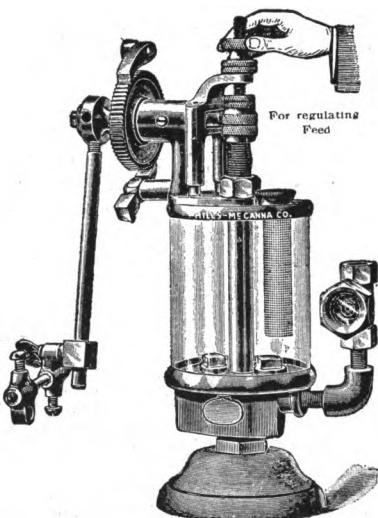
STEAM SPECIALTIES, FORCE FEED LUBRICATING PUMPS, HIGH-PRESSURE GAGE COCKS, SWING JOINTS FOR BEARINGS, LOW WATER ALARMS, METALLIC DISCS FOR VALVES

### FORCE-FEED LUBRICATING OIL PUMPS

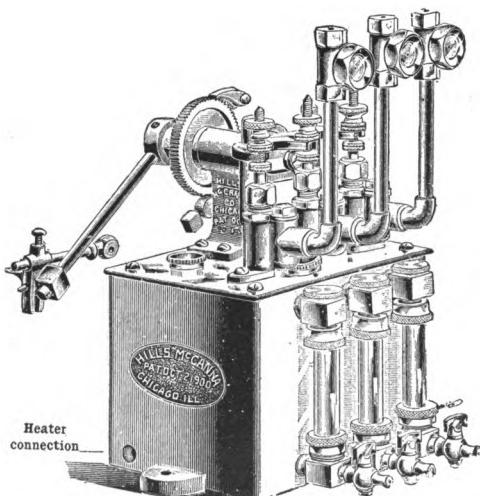
Our Oil Pumps have received the test of long use and varied applications, and have given thoroughly successful results.

The valves and operating motion are entirely outside of the Reservoir, and have a positive sightfeed, which can be regulated to any desired feed without stopping the pump.

Our pumps are made from one to any desired number of feeds.



Single Oil Pump with Glass Holder  
One Pint and One Quart sizes only



Triple Oil Pump, as made from One to any number of feeds

### APPLICATIONS

Hills-McCanna Force Feed Lubricating Pumps are illustrated in our catalog in successful service on

Elevator Pumps  
Boiler Feed Pumps  
Four-Valve Engines  
High Speed Engines  
Mine Motor Engines  
Gas Engines  
Steam Shovels  
Steam Hammers

Price list and further information on request.

# McCORD MANUFACTURING CO.

NEW YORK

DETROIT

CHICAGO

**"McCord" FORCE-FEED LUBRICATORS. "McKIM" GASKETS**

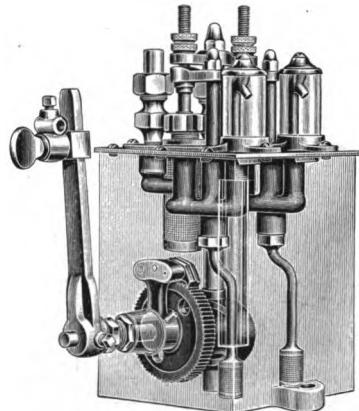
## "McCord" FORCE-FEED LUBRICATORS

Insure the positive delivery of just the right quantity of clean oil to just the right spot at just the right time—and in perfect synchronism with the engines or machines they are lubricating.

Interior mechanism is easily accessible; all working parts are of the best drop forged steel, case hardened, and are constantly running in oil, thus reducing wear to a minimum.

We guarantee each Lubricator perfect in every respect.

Write for Catalog "IL."

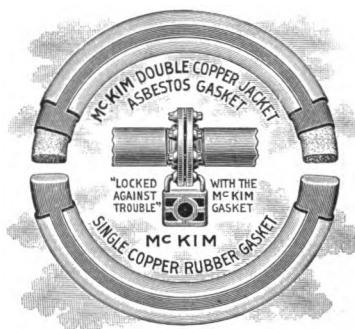


Class "B"

Number .....	1	2	3	4	5	6	7	8	9
Feeds—Number .....	1	2	1	2	3	1	2	3	4
Oil Capacity—Gallons .....	1/4	1/4	1/2	1/2	1/2	1	1	1	1

**"McKim"**  
**COPPER**

**GASKETS**  
**ASBESTOS**



"McKim" Gaskets back up every claim we make for them. And we claim that they make joints tight and keep them tight for years; that they will withstand the highest pressure and superheat; that they will not spread or "blow out," and that they may be applied again and again.

They are made of a shell of purest Lake Superior Copper, specially treated, enclosing a packing of Red Rubber or Asbestos—a combination impervious to heat, pressure, and chemical action of any circulation at a minimum tension of bolts and nuts. Made in all sizes and shapes and sold under a positive guarantee.

Save Time, Power, Labor  
Send for free sample and for Catalog "IG."

## Oiling Systems

# PITTSBURGH GAGE & SUPPLY CO.

PITTSBURGH, PA.

NEW YORK CITY: 136 Liberty St. BOSTON, MASS.: 54 High St. CHICAGO, ILL.: 174 N. Market St.

### LUBRICATING APPLIANCES

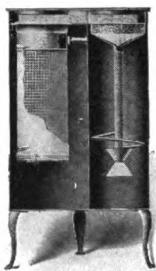
#### WHITE STAR OIL FILTERS AND OILING SYSTEMS

White Star Oil Filters are made in the following types:

*Round:* For small plants where a continuous oiling system is not contemplated, and delivery of oil is made to Filter by hand.

*Duplex:* For use in connection with automatic continuous oiling systems.

*Multiplex:* For oiling systems in very large plants. They are made for handling as much as 6000 gallons of oil per day.

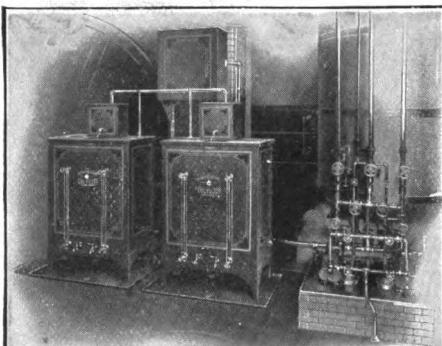


#### ROUND TYPE

Number of Filter	Filtering Capacity Gallons per 24 Hours	Holding Capacity, Gallons			List Price for Hand Operation	Ship- ping Weight lbs.
		Pure Oil	Dirty Oil	Water		
2	20	7½	5½	5	\$35.00	115
4	35	9½	7½	9	50.00	127
5	50	12	10	9	60.00	142
7	65	15	13	12	75.00	165
10	80	19	17	16	85.00	190
12	100	25	18	20	100.00	225

#### DUPLEX AND MULTIPLEX TYPES

Number of Filter	Filtering Ca- pacity, Gallons per 24 Hrs.	Holding Capacity Gallons			List Price	Shipping Weight, lbs.
		Pure Oil	Dirty Oil	Water		
8	100	13	10	8	\$95.00	190
17	150	38	11	8	125.00	285
20	200	64	17	14½	150.00	400
23	350	50	30	25	300.00	620
25	500	103	40	45	400.00	850
27	700	100	40	25	500.00	1000
50	1000	115	105	67	600.00	1500
100	2000	235	125	90	800.00	2000
150	3000	353	182	119	1000.00	2500
200	4000	476	257	177	1200.00	3000
250	5000	589	320	236	1500.00	3600
300	6000	710	365	236	1800.00	4200



A Typical Duplex Installation.

On request we will furnish bulletins showing our complete line of special Rotary, Double Acting, Simple and Duplex Pumps, Reservoirs, Separating and Drain Tanks, Sight Feeds, Compression Fittings, Piping Materials and accessories, special oiling devices and Force Feed Cylinder Lubricators.

In addition to manufacturing lubricating appliances, we make:

*Gaco Safety Water Gages;* a self-closing gage, the valves of which close instantly in case gage glass breaks.

*Gaco Take-Down Gage Cocks*—can be taken down under full head of boiler pressure.

*Pittsburgh Safety Water Columns*—Equipped with combined high and low water alarm attachment.

*Pittsburgh Steam and Oil Separators*—For removal of water and oil from live steam.

*Pittsburgh Recording Gages*—For recording pressure of steam, oil, gas, air; also vacuum.

*Pittsburgh Vacuum Exhaust Heads*—For removal of water, oil, etc., from exhaust steam.

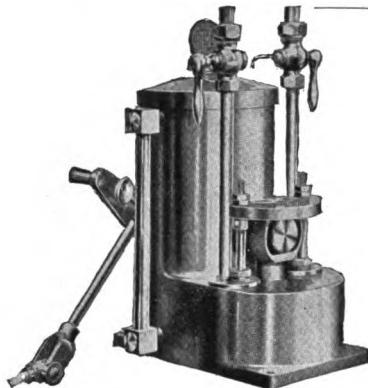
*Gaco Dust Collecting Systems.*

Pipe Bends and High Pressure Piping Work a specialty.

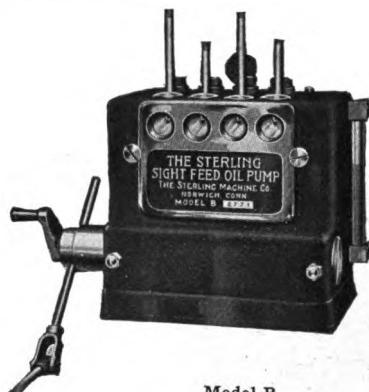
# THE STERLING MACHINE COMPANY

NORWICH, CONNECTICUT

ACME ENGINES, STATIONARY AND MARINE; DIRECT CONNECTED GENERATOR UNITS; STERLING LUBRICATORS FOR AUTOMATIC FORCE-FEED LUBRICATION



Model A



Model B

## STERLING FORCE FEED LUBRICATORS

are high grade oil pumps for providing positive lubrication with the minimum amount of oil. They are entirely automatic in action and save time as well as oil.

*Model A* is designed for use on steam engines and pumps and is made in the following sizes:

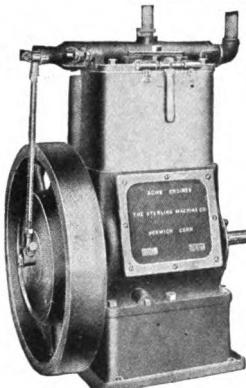
Number of Feeds	ONE						TWO						THREE						
	1	1	3	½	1	1½	1	3	½	1	1½	3	½	1	1½	3	½	1	1½
Tank Capacity...	Pt.	Qt.	Pt.	Gal.	Gal.	Gal.	Qt.	Pt.	Gal.	Gal.	Gal.	Pt.	Gal.	Gal.	Gal.	Pt.	Gal.	Gal.	Gal.

*Model B* is intended for use on large units and is especially adapted for lubricating the valves and cylinders of large gas engines, air compressors and similar units.

This model can be built in any capacity with any number of feeds. Standard sizes as follows:

Number of Feeds	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	4	5	6	1	1½	1½	1¾	1¾	2	2	2½	2½	2¾	2¾	3	3
Tank Capacity...	Pt.	Pt.	Pt.	Gal.												

## ACME STATIONARY STEAM ENGINE



Acme Stationary Engine

This Engine is an upright, double-cylinder single-acting engine, with cranks  $180^\circ$  to each other; pistons being  $1\frac{1}{2}$  times the stroke in length, form their own guides. Cranks are of drop forged steel, large size in diameter and length. Main bearings are  $2\frac{1}{2}$  times diameter of shaft, bushed with bronze, and can be renewed when worn, at small cost. Valve is of the balanced rocking type, of extra long and large wearing surfaces, and is placed on top of cylinders, the valve-case forming the cylinder heads. Lubrication is accomplished by carrying in the crank case a mixture of oil and water, into which the cranks dip at every revolution, and are not only flooded themselves, but throw the oil to every part inside the case.

These Engines are especially adapted for Mechanical Stokers, Small Independent Electric Light Equipments, Centrifugal Pumps, and for use with Exhaust or Ventilating Fans, Blowers, etc. Catalogues on request.

### ACME ENGINE SIZES FROM ONE HALF TO THIRTY-FIVE H.P.

Engine Model.....	1	2	3	4	5	6	7	8	9	10
Bore (inches).....	2½	3	3½	3¾	4	4½	5	5	6	7
Stroke (inches).....	3½	3½	3½	5	5	5	7	7	7	7

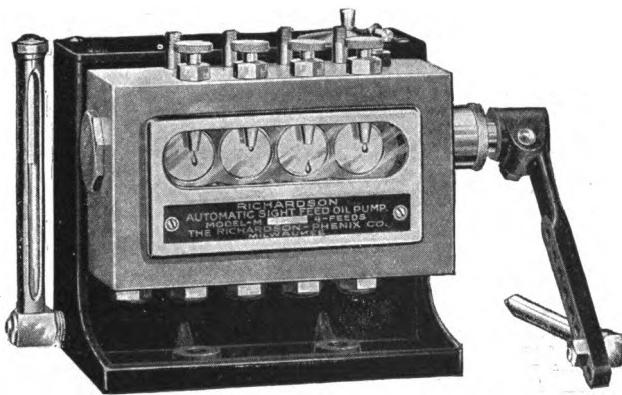
Any of the above sizes may be operated at a speed up to 600 R.P.M.

## THE RICHARDSON-PHENIX CO.

126 RESERVOIR AVE., MILWAUKEE, WIS.

LUBRICATION ENGINEERS AND MANUFACTURERS

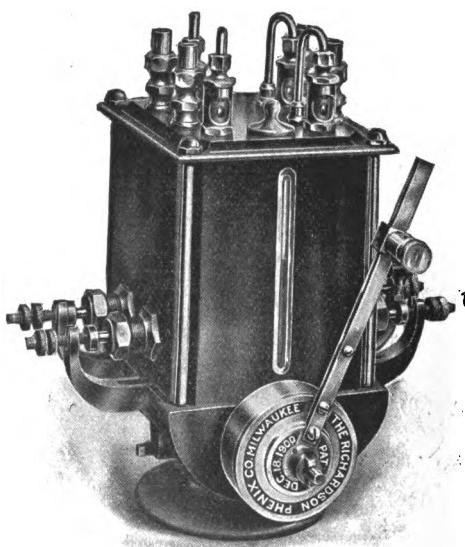
### THE RICHARDSON SIGHT FEED LUBRICATOR



operates on a new principle in that it supplies oil for cylinder lubrication in small particles for every stroke of the engine piston. Built in sizes of from one to twenty-two feeds and if desired can be furnished subdivided to handle two or more kinds of oil. Fully illustrated and described in catalog No. A-53.

### PHENIX LUBRICATOR OIL PUMPS

These lubricators are especially adapted to the lubrication of high-speed engines, all power plant auxiliaries, steam hammers, dredges, hoisting and traction engines, etc. Built in sizes from one to twelve feeds, square type and one to two feeds, round type. Can be furnished with divided tanks if desired. Salient Features: Delivers oil against any pressure up to several thousand pounds—at any lever stroke from  $\frac{1}{4}$  to 7 inches regardless of changes in temperature or viscosity of oil or length of feed line. Fully illustrated and described in catalog No. A-54.



# THE RICHARDSON-PHENIX CO.

126 RESERVOIR AVE., MILWAUKEE, WIS.

LUBRICATION ENGINEERS AND MANUFACTURERS

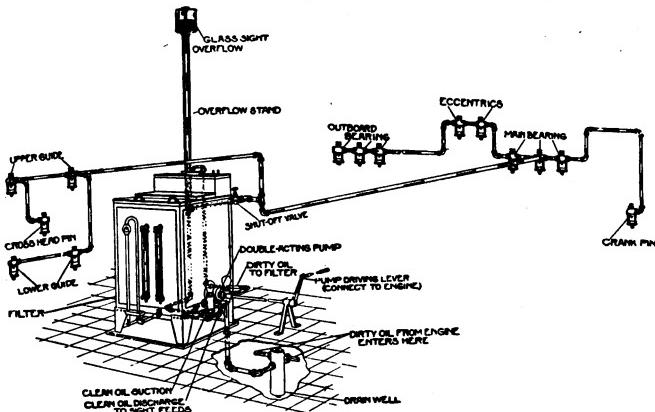
## CENTRAL OILING SYSTEMS

We advise and quote on the necessary material and apparatus or design and install complete Automatic Cylinder and Bearing Lubrication Systems, in which the oil is regularly and positively supplied in just the proper quantities and, in the case of bearing lubrication, is filtered and used over and over again.

Our experience in this work, extending over a period of many years, has placed us in possession of valuable data on this subject and there is hardly a question pertaining to machinery lubrication that we have not met and solved.

We would be pleased to correspond with those interested in reducing lubrication expenses, with a view of explaining our proposition in greater detail.

## INDIVIDUAL OILING SYSTEMS



Complete Richardson Individual Oiling System

RICHARDSON AND PHENIX INDIVIDUAL OILING SYSTEMS do away entirely with the necessity of installing overhead storage tanks, filters buried in the basement, or long lines of piping; starts and stops with the engine or machine to which it is applied and the entire system is always in sight of the engineer.

Salient features—low first cost, simplicity, efficiency, reliability.

Can be applied to any size and type of engine or power plant auxiliaries from 5 to 5,000 h.p. Fully illustrated and described in our 50 page Book A-55, "Scientific Lubrication of Machinery" which also contains the latest information on the application, use and selection of oils for all power plant purposes.

# ALBANY LUBRICATING CO.

ADAM COOK'S SONS, Props.

708-710 WASHINGTON STREET

NEW YORK, N. Y.

ALBANY GREASE AND ALBANY GREASE CUPS FOR THE LUBRICATION OF ALL KINDS OF MACHINERY, ESPECIALLY LUBRICATION WITH INFREQUENT ATTENTION. ALBANY GREASE HAS BEEN ON THE MARKET FORTY-FOUR YEARS.

Insist on Getting Package



with this Trade Mark

## TEMPERATURE AND LUBRICATION

It is of prime importance in lubrication that grease of the proper consistency be used.

No good bearing lubricant can have the same viscosity in both winter and summer temperatures.

The melting point of a pure body lubricant, such as Albany Grease, varies slightly in the different seasons of the year.

If you expect to derive the utmost value from this King of Lubricants you should specify the proper consistency according to the season.

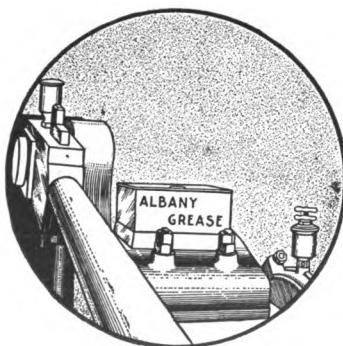
Take exposed journals in extremely cold weather, or slow-running journals under heavy pressure running in a cold room, you wouldn't expect to get the same results that you might in summer with the thermometer flirting with 90° in the shade.

In Albany Grease there are Soft Numbers (0 and 1) for cold and extreme cold weather. For moderate, warm and summer weather use No. 2 and No. 3.

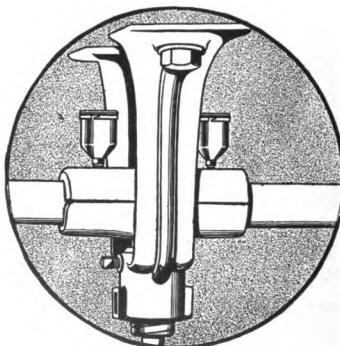
Albany Grease Nos. X, XX, or XXX have a "just right" consistency to adapt themselves to varying conditions of high or extreme temperatures.

The point is, there is an Albany Grease to meet *all* conditions.

The following illustrations show the adaptability and application of Albany Hand-made Cup on main bearing working in perfect harmony with Albany Spring Compression Grease Cup on eccentric and the Cast Spindle Grease Cup on crank pin. Also of the Albany Steel Funnel Cups on shafting feeding only when machinery is in motion. No drip or waste.



Albany Grease on Main Bearing



Albany Grease applied to Shafting

## THE TEXAS COMPANY

NEW YORK AND HOUSTON

**MANUFACTURERS OF LUBRICATING OILS, ENGINE AND MACHINE OILS AND GREASES. LUBRICATING OILS PREPARED ESPECIALLY FOR USE OF TURBINES, GRAVITY-FEED AND FORCE-FEED SYSTEMS UNDER ALL CONDITIONS.**

In the modern power plant the question of lubrication is one of vital importance. It is a question which, affecting as it does the general efficiency of the entire plant, cannot be decided off-hand.

Before an entirely satisfactory solution is reached great care and study are required on both the part of the consumer and the manufacturer. The consumer must be careful to the utmost in his selection and employment of an oil. The manufacturer must devote himself to the study of conditions and methods of lubrication to be in a position to meet consumer requirements.

This last represents the part played by The Texas Company in the field of lubrication. A careful consideration of consumer requirements combined with our extraordinary facilities—a high class organization and excellent crudes to work with—has placed The Texas Company in a position to furnish lubricating oils that display high efficiency in checking friction and promoting economic operation.

In the larger plants lubrication is a problem carrying extra gravity, due to the severer conditions of work and it is here that the value of **TEXACO LUBRICANTS** is most forcibly demonstrated.

**TEXACO LUBRICANTS** are peculiarly fitted to meet severe conditions. They lubricate perfectly, separate readily from any water that may get into the oil through leakage and they stand up well under severe work, maintaining as high lubricating properties after a thousand hours as shown when the oil was new.

Another very essential feature that contributes to the general excellence of **TEXACO LUBRICANTS** is their low cold test. This is especially important in large stations where the oil is pumped from a central filtering plant to the engine. It will eliminate the shutting down of the station in cold weather on account of the oil having congealed.

The **TEXACO OILS** for general, rolling-mill and manufacturing plant lubrication are of such a nature that great economy will result in their use. Every requirement of lubrication, whether power economy, general plant economy, or cost can be met by **TEXACO LUBRICANTS**.

We publish a quarterly—"Lubrication." It ought to contain something of interest to you. It's yours for the asking.

Address Department M. E.

17 Battery Place, N. Y. City.

THE TEXAS COMPANY.

## A. ALLAN & SON

494 GREENWICH STREET

NEW YORK

SOLE MANUFACTURERS OF ALLAN BRONZE, ALLAN RED METAL, ALLAN METAL  
VALVE DISCS, ALLAN BEARING BRONZES



### BEARING BRONZE

The Essential Qualities of a High Grade Bearing Bronze are:

That it will sustain the load without rupture.

That it will make the friction between the bearing and shaft as low as possible.

That it will give the longest possible service, with the smallest possible loss of metal by wear.

That it will require only a minimum amount of lubrication.

That it will not have a tendency to heat rapidly, causing the bearing to hug and tear the shaft.

A bearing alloy with these qualities is the highest standard of efficiency and a guarantee of low maintenance cost.

It is universally conceded that lead-copper-tin alloys possess the essential qualities of a high grade bearing bronze, but owing to the difference in specific gravity and fusing points of these metals, it is impossible to produce by ordinary foundry practice, lead-copper-tin alloys high in lead, without lead sweat or segregation.

Our alloys are not made by rule-of-thumb methods, but by the Allan process, the process whereby lead-copper-tin can be mixed into a homogeneous bronze. They are made from the best brands of Virgin metals.

It is impossible to produce a bronze of standard proportions which will be universally satisfactory for all work and conditions. To meet these conditions Allan Bronzes are made in several grades, according to service for which they are specified.

We recommend Allan No. 4 Bronze for crank-pin brasses, piston pin bearings on gas engines, driving boxes and rod brasses on heavy and high-speed locomotives. Allan No. 2 Bronze for thrust bearings on vertical rolls, pinion bearings on plate mills, where high temperature and excessive pressures are to be met.

Write our Engineering Department your service conditions. We give the most liberal guarantee of quality and efficiency.

## A. ALLAN & SON

494 GREENWICH STREET

NEW YORK

**SOLE MANUFACTURERS OF ALLAN BRONZE, ALLAN RED METAL, ALLAN METAL  
VALVE DISCS, ALLAN BEARING BRONZES**

### **ALLAN RED METAL**

**For Bearings, Pistons and Packings**

The introduction in locomotive, marine and stationary engine construction of the use of superheaters, and the results of greater efficiency thereby derived, is a noteworthy advancement in modern engineering practice. But with this forward movement arises troublesome details which have to be met and overcome.

One, of no little moment, is the need of a babbitt or antifriction metal to cope with the excessive heat of highly superheated steam. Allan Red Metal will give satisfactory service with steam at 175 pounds pressure and 200° superheat. It was never intended to displace white babbitt metal—but to overcome its shortcomings—to do the work white babbitt metal will fail to do.

Allan Metal faced pistons are recognized by mechanical engineers as the most advanced design in piston construction.

As shaft packing on steam turbines it has proven its efficiency over carbon.

It is a bearing alloy that cannot be melted out of a bearing, even under the most severe service condition, nor will it hug, stick to, scar or cut the pin or shaft.

Allan Metal Globe Valve Discs supersedes the vulcanized disc, due to their lasting qualities.

Allan Red Metal is as great an advancement in the metallurgy of antifriction metal as superheated is to saturated steam. They are both forward movements to greater efficiency in modern engineering practice.

Our Booklet, "The Heart of the Engine—The Seat of Power," is a treatise on piston design and will be mailed free upon request.

## THE AJAX METAL COMPANY

FRANKFORD AVE. & RICHMOND ST.

PHILADELPHIA, PA.

### BEARINGS, BRONZE BEARING METALS AND BABBITT METALS.

#### AJAX PLASTIC BRONZE

For about twenty-five years it has been known that copper-tin-lead alloys make the most successful bronze bearings. Previous to this copper-tin alloys without lead, known as gun metal, were the standard. Lead was found to give the alloy a certain yielding or plastic nature so essential to a good bearing metal. Later as the result of experiments made by the Pennsylvania Railroad, the following facts were proved:

- 1—Loss of metal by wear under similar conditions diminishes with increase of lead.
- 2—Loss of metal by wear under similar conditions diminishes with the diminution of tin.
- 3—Capacity for heating is likewise greatly reduced under the same conditions, viz: with increase of lead and diminution of tin.

Appreciating the value of higher lead and lower tin than is contained in other bearing alloys, we succeeded after long experiment in producing such a metal, and have been granted patents thereon. It is the alloys made under these patents that we term "Plastic Bronze." A guaranteed rate of wear 50 per cent slower than any other bronze on the market, and less liability of heating, under similar circumstances.

#### HOW DO WE KNOW IT WILL DO WHAT WE CLAIM FOR IT?

- 1—Knowledge gained by systematic study of the copper-tin-lead and the copper-tin-lead-zinc series of alloys on our up-to-date Testing Machine, especially designed for the purpose.
- 2—Experiments of the large Railroads in the country, and others who have been using it.

#### REFERENCES GLADLY FURNISHED

Plastic Bronze has now been on the market about ten years, during which time we have sold upwards of 50,000,000 pounds, which should speak for itself. We invite comparative tests, and will furnish sufficient material for such purpose, with understanding if same does not show 50 per cent longer life than any bronze on the market, it will be returned at our expense.

We solicit your valued attention.

#### AJAX BULL BABBITT

We have given this name to a special brand of Babbitt Metal made exclusively by our company, which is always poured into ingots having on their upper faces the impression of a bull's head. This metal was designed for general purposes and answers in ninety-nine cases out of a hundred where genuine Babbitt is being used.

It is a Babbitt costing only about half as much as the genuine, and in most cases it will do better work. It can be used for all bearings except those carrying an extremely heavy load, and will run cool at any speed.

We are selling tons of this metal every month and it is giving entire satisfaction wherever used.

#### AJAX GENUINE BABBITT

Our genuine Babbitt metals are strictly composed of copper-tin and antimony, made in two grades for distinctive uses. We guarantee these to be alloyed in such manner that the structure shall be uniform and free from segregation.

#### OTHER AJAX PRODUCTS

Are described in our complete catalogue.

## LUMEN BEARING COMPANY

BUFFALO

TORONTO

BRASS FOUNDERS

---

**LUMEN BRONZE BEARINGS** are the standard for comparison. We recommend their use in electric motors, machine tools, bridge bearings, heavy compression service, etc.

Lumen is 25% lighter than any bronze capable of the same bearing capacity, and about 40% less expensive.

(Special pamphlet will be mailed upon request.)

**L. B. MANGANESE BRONZE** is of unusual merit and above the average.

It will show a tensile strength of at least 75,000 lbs., with other physical properties in proportion.

**No. 8 ALLOY (PURE COPPER)** is for electrical purposes requiring a conductivity of 85. This test in sand castings is unusual, and the product has met with instant commercial favor.

**OUR COPPER-TIN-LEAD-ZINC ALLOYS** are standard for various purposes. Full information will be gladly furnished.

**BABBITT METALS** made to your formula or ours.

**SCIENTIFIC METALLURGY** is the basis on which we have built our reputation. Our laboratory directs the composition and controls the manufacture of all alloys.

Our experience and research work enable us to furnish reliable engineering data concerning the physical properties and uses of bronze and other non-ferrous alloys.

## MAGNOLIA METAL CO.

NEW YORK  
113-115 Bank Street

CHICAGO  
Fisher Building

MONTREAL  
225 St. Ambroise St.

### MAGNOLIA METAL

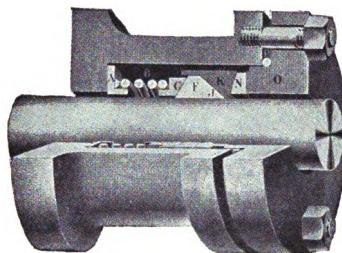


FAC-SIMILE BAR OF MAGNOLIA METAL

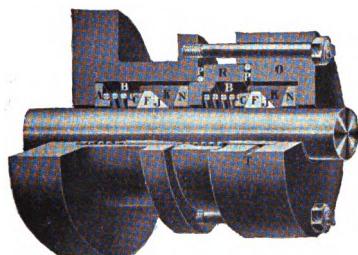
- COEFFICIENT OF FRICTION** Tests by great governments and eminent mechanical experts all show that Magnolia has the smallest coefficient of friction of any known bearing metal. The United States Government test—when *water* was used as the lubricant—300 lbs. pressure per square inch, 491 R. P. M., showed a frictional coefficient as low as 0.0008. The test by the French Government—710 lbs. pressure per square inch, 6.56 ft. per second—lubricant “black oil,” showed coefficient 0.0012.
- WEARING QUALITIES** Magnolia ran over twenty-three years on log mandrel bearings and was in good condition when plant was permanently shut down. It is the rule rather than the exception for Magnolia lined bearings to run for five and ten years and longer.
- HEAVY PRESSURES** Thousands have testified that Magnolia is the only metal that will stand the heavy pressure on their bearings: proving superior to and out-wearing bronze and brass in Rolling-mill work, etc. Professor John Goodman, the well known English authority, says of Magnolia—“The higher the pressure that is applied to a Magnolia bearing, the better does the wearing surface become.” He tested it up to two tons per square inch.
- HIGH SPEED** Magnolia is used largely in thousands of wood-working and other plants where both the speed and duty are very severe and is extolled for its lasting and other qualities. It commonly runs in such places from four to fifteen years.
- LUBRICATING QUALITIES** Magnolia is largely a self lubricating metal. In the *water* test by the U. S. Government Magnolia was run for 5 hours up to 600 lbs. inch<sup>2</sup> pressure—the limit of machine—490 R. P. M., and proved to be 200% superior antifrictionally to a conventional Babbitt of the same formula as Magnolia but not subjected to the same special foundry treatment and 1100% superior to white brass. Magnolia has run six years on shafting bearing without a drop of lubrication and Engineers very often speak of large saving in oil on Magnolia bearings.
- GRIT** We have great numbers of letters laying particular stress upon the wonderful wearing qualities of Magnolia bearings that are subjected to grit and dust in Cement Mixers, etc. etc.
- DETAILS** We will gladly send our advertising literature giving full particulars to any one interested.

## C. LEE COOK MANUFACTURING CO. LOUISVILLE, KY., U. S. A.

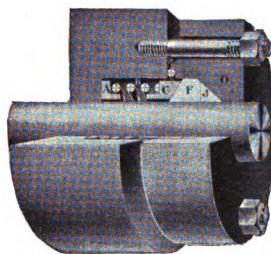
COOK'S METALLIC PACKING FOR STEAM, GAS AND AIR, ON POWER ENGINES OF EVERY DESCRIPTION; ESPECIALLY ADAPTED TO EXTRA HEAVY DUTY SERVICE ON REVERSING BLOOM MILL ENGINES, BLOWING ENGINES, ROLLING MILL ENGINES, GAS ENGINES, MARINE ENGINES, LOCOMOTIVES, AND ENGINES OPERATING UNDER VERY HIGH STEAM PRESSURE AND SUPERHEAT.



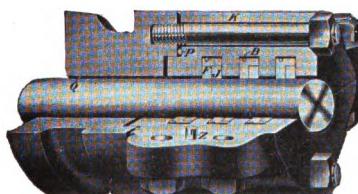
No. 1 Type Packing



No. 2 Type Packing



No. 3 Type Packing



No. 6 Type Packing

### SINGLE TYPE PISTON ROD PACKING

Is familiar to every leading engine builder in the United States. We have had satisfactory and agreeable business relations with them all.

It is simple, and economical as compared with other types of Metallic Packing, and has special merit not afforded by others. An examination of its construction will be proof sufficient that it is *steam tight*, will not cut, or score the rod, and operates with minimum friction.

### DOUBLE TYPE PISTON ROD PACKING

A trying difficulty before the successful operation of Metallic Packing, is the elimination of condensation. We accomplish this by placing two sets of Metallic Packing together, as seen in the cut. The upper, or main set, holds the pressure while the lower set arrests the water and conveys it to the threaded opening "T" of the lower Gland "O". A valve and a drain pipe is attached to this, and after the engine is hot, and condensation reduced to a minimum, the valve may be closed, thus putting into action two sets of packing, operating as one. Result: DOUBLE DURABILITY.

### CORLISS VALVE STEM PACKING

The cut delineates how simple is this packing's design. It is so near frictionless that there is no appreciable difference offered to the turning of the stem when the packing is on or off. Hence, when this packing is applied, the Valve Gear operates under a uniform condition, and averts the need of continual adjustment of dash-pots. For high vacuum service, we put two sets of this packing together, as illustrated in our Double Piston Rod Packing, and inject a steam seal under pressure through the opening which forms the drain in the former case. This hermetically seals the vacuum.

### SPLIT PISTON ROD PACKING

The cut delineates our outside type of packing cage, but we make it in any design that requirements or preference demands. Hence we can completely insert it in the stuffing box, using the fiber gland to hold it in place, or we can partly insert it with its outer end in the shape of a flange drilled to receive the studs, and thereby serve as

the gland. We make packing rings for this type of packing in over six designs, all depending upon the preference of the engineer and the requirements of the service. A striking innovation in split packings is our copper gasket that forms a joint between the stuffing box and the packing case.

## GOETZE GASKET AND PACKING CO.

22 ALLEN AVE.

NEW BRUNSWICK, N. J.

METAL GASKETS OF VARIOUS TYPES. METALLIC ENGINE PACKING. SHEET  
PACKING FOR FLANGES. VALVE GASKETS.

### "DEVO" GASKETS

The latest Goetze product is the new DEVO Gasket for high pressure, superheated and saturated steam and other unusually severe conditions. This gasket is fully described in five words: Corrugated—Steel—Asbestos—Covered—Graphited.

It combines the great mechanical strength and everlasting durability of Goetze copper and asbestos gaskets, while at the same time it is sold at a much lower price. In fact, a price which compares favorably with inferior gaskets.



DEVO Gaskets appeal to every practical engineer because they are *absolutely indestructible* and the nearest approach to a *permanent and everlasting* gasket that has ever been attained.

### OUR FIVE YEAR GUARANTEE

Every *Devo Gasket* is guaranteed for five years and will be replaced within that time if it fails to make good. Will make any pipe line *absolutely tight* and will never blow out.

### SHIPPED ON 90 DAYS' TRIAL

And you need not pay for them if they fail to make good on every claim. We take the chances, not you.

Goetze's Elastic Corrugated Copper Gasket with Asbestos Lining No. 2, for flanges, makes a joint practically as leak-proof as the pipe itself, even with the roughest, most uneven surfaces.

### GOETZE'S VALVE GASKETS

save trouble and money. They are for Valves of Jenkins Type and are made of copper and asbestos.

### "GOETZERIT"

is a sheet packing for flanges made from pure, prime, asbestos fibre, compressed under an exceedingly high pressure and impregnated with a substance which makes it proof against the action of superheated and saturated steam, acids, ammonia, gas, alkaline products, etc. It is made in sheets approximately 39 inches by 39 inches of any desired thickness, and ready-made gaskets for standard and extra-heavy flanged fittings of from one inch to 24 inches in diameter are kept in stock. Price in sheets \$1.00 per lb.

# GOETZE GASKET AND PACKING CO.

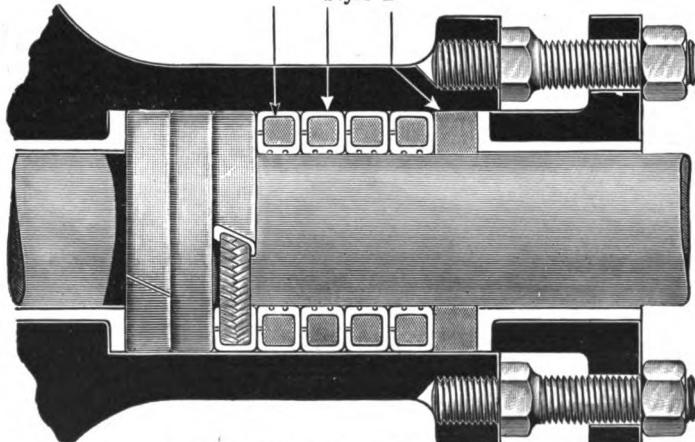
Goetze's Gaskets are a guarantee against frequent, costly shut-downs for packing renewals.

## Price List

For Standard Flanged Fittings		||			For Extra Heavy Flanged Fittings	
Price per Goetze No. 2 Gasket	Price per Devo Gasket	Size of Gaskets in. X outs. dia.	Size of Pipe	Size of Gaskets in. X outs. dia.	Price per Devo Gasket	Price per Goetze No. 2 Gasket
		inches	inches	inches		
.16	.13	1 $\frac{1}{4}$ x 2 $\frac{1}{2}$	1	1 $\frac{1}{4}$ x 2 $\frac{7}{8}$	.14	.18
.20	.16	1 $\frac{1}{2}$ x 2 $\frac{3}{4}$	1 $\frac{1}{4}$	1 $\frac{1}{2}$ x 3 $\frac{1}{8}$	.21	.27
.24	.19	1 $\frac{3}{4}$ x 3	1 $\frac{1}{2}$	1 $\frac{3}{4}$ x 3 $\frac{1}{2}$	.24	.30
.32	.25	2 $\frac{1}{4}$ x 4	2	2 $\frac{1}{4}$ x 4 $\frac{1}{4}$	.29	.36
.40	.32	2 $\frac{3}{4}$ x 4 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{3}{4}$ x 5	.36	.45
.48	.38	3 $\frac{1}{4}$ x 5 $\frac{1}{2}$	3	3 $\frac{1}{4}$ x 5 $\frac{1}{2}$	.43	.54
.56	.45	3 $\frac{3}{4}$ x 6 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{3}{4}$ x 6 $\frac{1}{2}$	.50	.63
.64	.51	4 $\frac{1}{4}$ x 6 $\frac{5}{8}$	4	4 $\frac{1}{4}$ x 7	.57	.72
.72	.57	4 $\frac{3}{4}$ x 6 $\frac{5}{8}$	4 $\frac{1}{2}$	4 $\frac{3}{4}$ x 7 $\frac{5}{8}$	.65	.81
.80	.64	5 $\frac{1}{4}$ x 7 $\frac{1}{8}$	5	5 $\frac{1}{4}$ x 8 $\frac{1}{8}$	.72	.90
.96	.77	6 $\frac{1}{4}$ x 8 $\frac{5}{8}$	6	6 $\frac{1}{4}$ x 9 $\frac{1}{4}$	.86	1.08
1.12	.89	7 $\frac{1}{4}$ x 9 $\frac{1}{8}$	7	7 $\frac{1}{4}$ x 10 $\frac{1}{8}$	1 -	1.26
1.28	1.02	8 $\frac{1}{4}$ x 10 $\frac{1}{8}$	8	8 $\frac{1}{4}$ x 12	1.15	1.44
1.44	1.15	9 $\frac{1}{4}$ x 12 $\frac{3}{8}$	9	9 $\frac{1}{4}$ x 13	1.29	1.62
1.60	1.28	10 $\frac{1}{4}$ x 13 $\frac{1}{2}$	10	10 $\frac{1}{4}$ x 14 $\frac{1}{4}$	1.40	1.80
1.92	1.35	12 $\frac{1}{4}$ x 16	12	12 $\frac{1}{4}$ x 16 $\frac{1}{4}$	1.73	2.16

### GOETZE METALLIC PACKING

Style D



For Steam Engines, Pumps, Compressors, Etc.

WILL KEEP

Your PISTON rod perfectly smooth.

WILL LAST

For years, and that's how you will save a lot of worry and unnecessary work in repacking.

OUR GUARANTEE

Will be for three years, providing the piston rod is true and in good condition.

Write us at once and we will be glad to send full particulars and price.

THE FRANCE PACKING COMPANY  
TACONY, PHILADELPHIA  
FRANCE METAL PACKING

For Every Service

FRANCE METAL PACKING

France Metal Packing for steam, air, gas or ammonia is made of Vanadium Cast Iron—the best wearing metal known.

For superheated steam on Vertical Engine, Bronze or Bell Metal is used, depending upon the pressure.

The cases are made of cast iron.

The packing is designed for your engine and your conditions. It will last from 5 to 20 years. It is rented or sold on approval.

France Packing is NOT a lead, babbitt, shredded, graphited or semi-metal packing that destroys your rods.

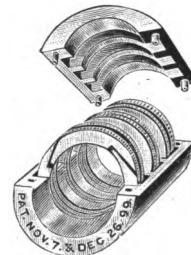
It is made of a tough metal, machined to fit your engine. Nothing but metal touches the rod.

We guarantee satisfaction or expect no pay.



What our Steam Packing will pack

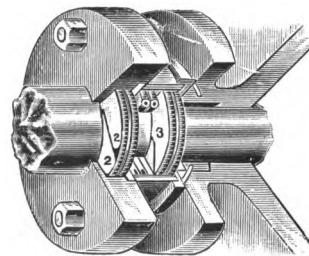
France Metal Packing will pack any round steam, air, gas and gaseous ammonia rod, any pressure, speed or temperature. Any piston rod of any type of engine or pump, whether vertical or horizontal. It will pack any valve stem, whether reciprocating or oscillating.



Inside Split Packing

What our Hydraulic Packing will pack

It will pack any true pump rod, plunger or valve stem pumping any kind of liquid, no matter what the pressure or temperature. Any elevator rod or plunger. Any rod working in liquid.



Outside Solid Packing

Space Required

For inside split packing, the inside diameter of the stuffing box must be from  $1\frac{1}{4}$  in. to 2 in. greater than the rod diameter.

Outside packing requires 3 in. from face of stuffing box.

# THE METALLIC PACKING & MFG. CO.

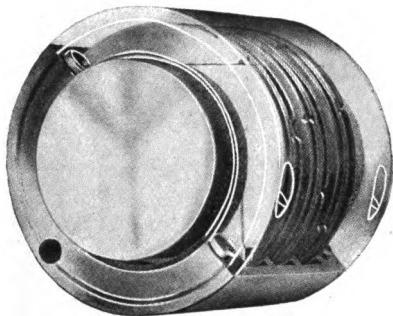
L. H. MARTELL, Mechanical Engineer & Gen'l Manager

ELYRIA, OHIO

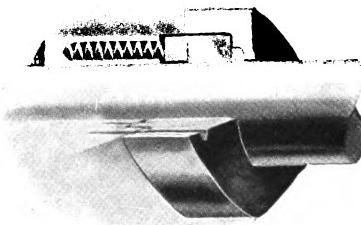
**MAKERS OF MARTELL PACKINGS**

## MARTELL METAL PACKINGS

Martell Metal Packings embody the results of more than twenty years spent in design, manufacture, sale and use of all kinds of packings. They are made to meet all conditions and are in successful use in connection with steam, gas, water, oil and chemicals of various kinds.



For steam piston rods in ordinary size and service



For Corliss valve stems

We believe and can demonstrate that the design of Martell Metal Packings obtains a maximum of efficiency, economy, safety and simplicity.

All Martell Piston Rod Packings float freely and easily with the lateral motion of the piston rod.

Martell Corliss Valve Stem Packings rotate with the stem, and support same. They never cut or abrade.

Do not confuse Martell Metal Packings with so-called metal packings that depend upon distortion or forcible compression of metals. Martell Metal Packings are strictly mechanical and automatic, and to this is due their exceptional efficiency, long life and economy.

The experience gained by twenty years of painstaking observation and careful analysis without prejudice is always at the disposal of designers, builders or owners of power plants, or other machinery requiring packing.

Many of the largest power installations in the country are fitted with Martell Metal Packings. They are strictly guaranteed and will be placed on approval.

# THE GARLOCK PACKING COMPANY

PALMYRA, N. Y.

New York  
Chicago

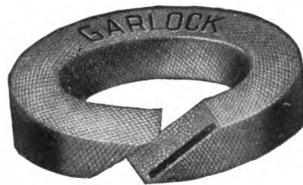
St. Louis  
Cleveland

Denver  
Boston

Pittsburgh  
New Orleans

Philadelphia  
San Francisco

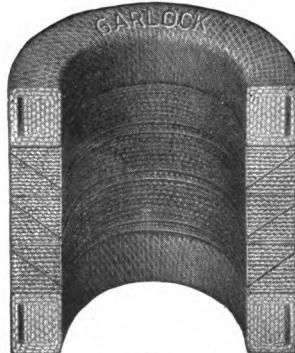
**MANUFACTURERS OF FIBROUS AND METAL PACKINGS FOR EVERY CLASS OF SERVICE.**



Style No. 200

Style No. 200 High Pressure Packing will give reliable and efficient service without injury to piston rods, because it is thoroughly lubricated throughout every fibre, and the material, design and workmanship are unequalled for use against high-pressure steam.

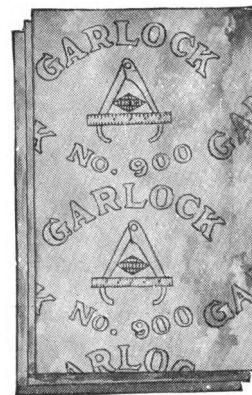
Style No. 900 Sheet is not affected by any temperature up to 670° Fahrenheit, and has a tensile strength of more than 6000 pounds per square inch. It is adapted to steam, air, ammonia, acids, or any service where a sheet packing can be used—particularly desirable for superheated steam.



Style No. 446

Style No. 446 Duo for medium pressure is a combination of High-Pressure and Sectional

Rings put up in sets to exactly fill stuffing box. The Sectional Rings adapt themselves automatically to rods not running true, while the High-Pressure Rings bear the brunt of the pressure and heat at bottom of stuffing box.



Style No. 900

Garlock Packings are made in over two hundred styles and combinations to meet every known requirement. We will assume entire responsibility in selecting the proper styles or combinations of our packings to work successfully and economically under any stated conditions; and if goods are not wholly satisfactory to customer we will refund promptly the cost of same. A card will bring our catalog which fully illustrates and describes our various styles of packings.

**THE B. F. GOODRICH COMPANY**  
AKRON, OHIO  
Offices in all principal cities  
**MANUFACTURERS OF MECHANICAL RUBBER GOODS, TIRES, ETC.**

**HOSE**

**WATER HOSE** covers a wide range of usage, making it quite out of the question to advance any specific recommendations as to quality.

"WHITE ANCHOR" and "AKRON"—special grades for unusual conditions of service.

"TRITON," "CASCADE," "DELUGE,"—regular grades for all general purposes. Braided fabric water hose—in either smooth or corrugated cover.

**STEAM HOSE** must be heavily constructed to stand the pressure, and the inner lining must be so compounded as to resist the action of steam under varying temperatures.

"GOODRICH"—for high pressure. This is truly a long-life hose.

Special coverings for steam hose: Red Painted woven cotton cover, Woven Marlin Cover, Asbestos Wire-Wrapped cover.

**PNEUMATIC HOSE** wrapped duck—50' length style:

"GOODRICH"—the highest quality for the hardest service.

"AKRON"—the standard hose, for all general purposes.

Wire wrapped pneumatic tool hose.

**BRAIDED-FABRIC PNEUMATIC HOSE**—smooth or corrugated.

**AIR DRILL HOSE** is heavily constructed throughout with a layer of canvas on the outside as a protection against cuts and abrasions.

"GOODRICH"—exceptionally high quality, unequalled for wear.

"QUARRY"—our standard grade and biggest seller.

**BOILER WASHOUT HOSE** is made in extra heavy weight to withstand the rough service it encounters. We advocate our heavy "Boiler Washout Hose" for turbine tube cleaner work. Made in two grades, "Goodrich" and "Akron."

**SUCTION HOSE** is made in a variety of grades to suit any purpose, either smooth or rough bore style.

**DREDGING SLEEVES, OIL SUCTION HOSE, OIL WELL DRILLERS' HOSE, OIL CONDUCTING HOSE, GASOLINE HOSE, SAND BLAST HOSE, COKE HOSE, MARINE DECK HOSE**, all especially adapted to the purposes for which they are made.

**PACKING**

**RED SHEET PACKING**—an excellent product, in two grades.

**RED SHEET BRASS WIRE INSERTED** in the same grades.

**DIAPHRAGM AND CLOTH INSERTION:** Packing highly recommended for their proper uses.

**SUPER HEAT PACKING**, a combination of rubber and asbestos, especially adapted for high pressures.

**RED TUBULAR GASKET PACKING, SPIRAL SQUARE DUCK PACKING, ROUND AND SQUARE DUCK PACKING, SQUARE RUBBER BACK, ROUND PISTON PACKING, AND PURE GUM STRIPS** all made to supply the demand for these various kinds.

**RUBBER GASKETS**

All grades and shapes. No matter what your requirements may be, we can supply them.

**RUBBER PUMP VALVES**

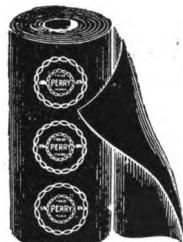
There is no class of our product which we take greater pride in stamping with the GOODRICH trade mark. Our list of grades is complete; we are always glad to give special attention to unusual conditions.

Made in grey or red rubber.

## LA FAVORITE RUBBER MFG. CO.

PATERSON, N. J.

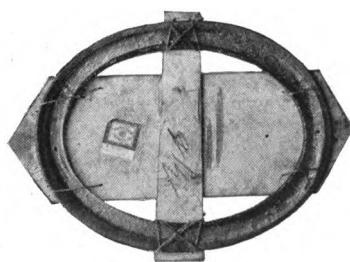
MANUFACTURERS OF PERRY SPECIALTIES, PACKING, GASKETS, VALVES,  
RUBBER GOODS, ETC.



Perry Sheet Packing



Gauge Glass Washers



Double Fold Gaskets

having been used five times to repack the same joint. The engineer was so well pleased he returned it of his own accord, that we might see it.

### GILT EDGE PISTON PACKING

Made Round, Oval and Square.

There is no piston packing today more conscientiously made to give service than Gilt Edge Red Core or Plain Piston Packing.



"Gilt Edge" Piston Packing



Semi-Metallic Valve Disc

The fine lubrication used, the best long fibered duck and the rubber to create the cushion and bind it together make it as good as we know how to make it after 40 years of experience.

It is used in some high speed engines many months over a year, and as a Valve Stem Packing it cannot be improved.

We make any size piston packing for any service and pressure up to 5,000 lbs.

### SEMI-METALLIC VALVE DISCS

High Pressure, Radiator and Soft Rubber.

Our high pressure discs are used on superheat steam pipe lines with wonderful success—write for a sample to test, you will not use anything else.

We stock the sizes to fit Standard Valves.

Complete catalogue of Perry Products on Request.

## CLEMENT RESTEIN COMPANY, INC.

PHILADELPHIA, U. S. A.

## BELMONT HOLLOW CENTER PACKING

This is a recently perfected steam and hydraulic packing, which is made with a "Hollow Center," for, while the hole weighs nothing and therefore costs nothing, this hole is really something of great importance.

Belmont Hollow Center Packing, Style No. 19, a ring of which is here shown, has several important advantages over all solid packings of either the square, round or wedge construction. In removing the old style "rubber core" and making this material with a hollow center the manufacturers have achieved remarkable results. First, having a hollow center, it weighs much less than the solid packings, and price per pound being the same, the cost for packing a given rod or plunger is much less. More important than this, however, is the fact that the hole provides a place for all excessive expansion or swelling, with the result that there positively can be no more friction on the rod or plunger than is necessary to withstand the initial pressure. Nor can it become tight enough on the rod or plunger at any time either from undue gland pressure or swelling to run hot and "burn."

The hollow center packing is in a way automatic in its action under the changing conditions and does not require constant and careful attention to make it last long and give satisfaction. The secret of its success lies in the hollow space which provides for all conditions of both expansion and contraction. For example, when a solid or wedge shape packing begins to swell and expand from absorption of steam or hot water, extreme temperature or for any other reason, it immediately becomes tight on the rod or plunger, causing excessive friction which quickly wears away the packing. At this point, if the expansion is not entirely out and the Engineer neglects to loosen the gland nuts, its continued swelling is quite apt to cause the packing to run hot and burn.

The action of the Hollow Center packing under these conditions is quite different. The hole provides a place for this excessive swelling or expansion and instead of becoming tight on the rod or plunger, the swelling goes to the hole or point of least resistance. Result—no excessive friction—packing does not wear away quickly—cannot become hot and burn.

It is recommended for steam, ammonia and oils, for elevator plungers, hot and cold water pumps and all conditions of hydraulic service where a stuffing-box packing is required. It is particularly efficient on outside packed boiler-feed pumps for hot water where much trouble is experienced with solid packings on account of excessive swellings. Try it. Your initial trial order will be filled with a positive guarantee to give you satisfaction or no pay. May we have a trial order under these conditions? Booklet illustrating and fully describing Belmont Hollow Center Packing for the asking.



Belmont Hollow Center Packing, Style No. 19

## *Thermometers, Gauges, etc.*

# THE SCHAEFFER & BUDENBERG MFG. CO.

BROOKLYN-NEW YORK

CHICAGO

WASHINGTON

PITTSBURGH

INSTRUMENTS FOR MEASURING, INDICATING, AND RECORDING,  
TEMPERATURE, PRESSURE, AND SPEED



"Crescent" Thermometer



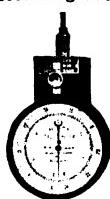
"Reform" Thermometer



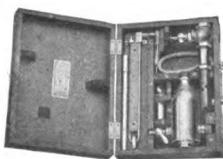
"Columbia" Recording Thermometer



The Columbia Recording Gauge



"Columbia" Tachometer



Calorimeter

### "CRESCENT" THERMOMETERS

We are pioneers in the manufacture of industrial Thermometers of every description. Among our line of high grade "Crescent" Thermometers will be found an instrument for practically every purpose, and our catalog No. 27 illustrates over seventy types. Handsome in appearance, faultless material and perfect in mechanical detail and construction.

Specify size of scale case desired, graduation, character and size of connection, character and length of stem, and the purpose for which the thermometer is to be used.

### "REFORM" THERMOMETERS

A dial face, *mercury filled*, indicating thermometer having the accuracy of the standard glass tube thermometer and the conveniences of a dial face instrument. Entire working mechanism is made of steel, meaning long life. Standard size of dial 6 inches. Other sizes made to order. Furnished with either rigid connection or flexible capillary steel tube connection. The latter greatly facilitates installation. State the graduation desired, character and length of connection, and the purpose for which the thermometer is to be used.

### "COLUMBIA" RECORDING THERMOMETERS

Acknowledged to be the most simple, yet the most reliable type of Recording Thermometer. *Mercury actuated*, therefore absolutely accurate. Steel construction throughout combining *extreme strength and durability* with accuracy. Uniformly graduated, wide and effective ranged charts with the popular day and night border, made in two sizes, 8" and 12" respectively, for 24 hours or 7 days. Furnished with either rigid connection or flexible steel protected steel capillary connecting tubing of any length.

State size of chart and graduation, length and character of connection and the purpose for which the recorder is to be used.

### THE COLUMBIA RECORDING GAUGE

The "Gem" of Recording Gauges. Its chief feature is its great reliability, then comes its wonderful durability. Thousands in daily use. Adapted for any purpose. In portable and stationary types, for 8" and 12" day and night charts respectively, making one revolution in 24 hours or 7 days as desired.

State size of chart and graduations, and the purpose for which the Recorder is to be used.

### "COLUMBIA" TACHOMETERS

We have a most complete line of Hand and Stationary Tachometers, and we have recently added many new styles and types, covering absolutely every requirement met with in practice. Constructed on the most modern principles, accuracy guaranteed, compact and durable in construction, perfect in mechanical detail and handsome in appearance.

State desired graduations and if Stationary type of Tachometer is wanted, the diameter and the normal speed of the shaft you will drive from.

### CALORIMETERS

We manufacture Professor Carpenter's pattern Calorimeters for Steam and Coal. The throttling type of Steam Calorimeter serves for determining the amount of moisture contained in saturated or superheated steam, while the Separating type is designed to show the percentage of water by mechanical separation of the water from the steam. The Coal Calorimeter is of great value in Power Plants as it determines the calorific power of coal almost directly in B. T. U.

S. & B. Calorimeters are easily operated, requiring no special technical knowledge, and results are most satisfactory for practical problems.

## C. J. TAGLIABUE MFG. CO.

396-398 BROADWAY, NEW YORK, N. Y.

Manufacturers of

INSTRUMENTS FOR INDICATING, RECORDING AND CONTROLLING TEMPERATURE  
AND PRESSURE.



Hohmann-type  
Thermometer

### MERCURIAL THERMOMETERS

Hohmann-type, as well as types of lower quality, in various sizes, forms and scale-ranges as required for the particular applications to

Stationary Power Plants

Marine Power Plants

Refrigeration Systems

Water Cooling and Distillation

Ventilating and Heating, etc.

### AUTOMATIC CONTROLLERS

Of several types and various forms, according to requirements, for automatically maintaining—at exact point desired—either temperature or pressure when applied to

Condensers

Forced and Induced Draft

Feed Water Heaters

Systems

Hot Water Service Tanks

Water Purification

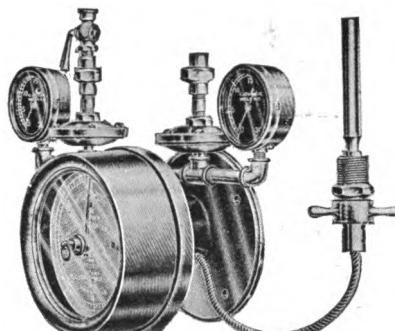
Stoker and Blower Systems

Condensing Systems, etc.

Also for automatically maintaining a constant Water Level in Steam Boilers.

### GAGES

Mercurial, Water and Oil, of various types, for Vacuum and Pressure.



"Perfect" Type Automatic Temperature Controller

### OIL TESTING INSTRUMENTS

Hydrometers, Viscosimeters, Flash and Burning Point Testers, Freezers, Gage and Wantage Rods, etc.

### MISCELLANEOUS

Engineers' Testing Sets, Pyrometers, Barometers, Hygrometers, Hydrometers, Orsatt Apparatus, etc.

# TAYLOR INSTRUMENT COMPANIES

ROCHESTER, N. Y.

"Where *Tycos*: Thermometers Come From"

NEW YORK  
Bank of Metropolis Bldg.  
31 Union Square

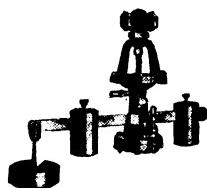
BOSTON  
44 High Street

CHICAGO  
Heyworth Building  
29 E. Madison St.

MANUFACTURERS OF A COMPLETE LINE OF INSTRUMENTS FOR THE INDICATING,  
RECORDING AND REGULATING OF TEMPERATURE AND PRESSURE.



*Tycos* Thermometers for every purpose and application, including the famous  "Tycos" Type; *Tycos* Recording Thermometers in both Self-Contained and Capillary form; *Tycos* Index Thermometers, etc., Indicating and Recording any range of Temperature from minus 328°F to 1000°F.



H & M *Tycos* Automatic Temperature and Pressure Regulators for processes requiring uniformity of Temperature or pressure conditions.



*Tycos* Time Valves, in conjunction with  "Tycos" Regulators, make it possible to continue a process at a given temperature for a desired period of time, at the expiration of which the steam line is closed off and the exhaust opened, terminating the process.



*Tycos* Rotary Switchboards are made for the control of any number of High Temperature Stations, up to and including twenty.



## *Tycos* Pyrometers—

Base-Metal from 200°F to 1800°F.

Rare-Metal from 1000°F to 2500°F.

Foster *Tycos*: Fixed Focus Pyrometer is the most dependable portable instrument.

FERY RADIATION PYROMETER has no top limit. It is extremely sensitive and in action is almost instantaneous.

## SMOOTH-ON MANUFACTURING CO.

570-572-574 COMMUNIPAW AVENUE

JERSEY CITY,

NEW JERSEY

SMOOTH-ON IRON CEMENTS AND SMOOTH-ON CORRUGATED  
METAL GASKETS



"Trade Mark-Reg. U. S.  
Pat. Off."

### SMOOTH-ON IRON CEMENTS No. 1 AND No. 2

These cements are chemical Iron Cements, prepared and sold in powder form for repairing leaks or breaks in castings and for making connections in steam or hydraulic work. They withstand fire, water, steam, oil and very high pressures. No. 1 is quick hardening. No. 2 is slow hardening and hydraulic. They must be applied to cold metal as a paste or putty. Expansion and contraction when hard, the same as cast iron.

### SMOOTH-ON ELASTIC CEMENT No. 3

This is an Iron Cement, prepared and sold in paste form for use on all seams of boilers or tanks to stop leaks, for boiler patching and for screw-thread joints. Also for repairing very fine cracks. This cement is hardened by heat and is applied as a paint, paste or putty to hot or cold metal. Expansion and contraction when hard is the same as cast iron.

### SMOOTH-ON CASTINGS No. 4

This is a chemical Iron Cement for repairing blemishes, blowholes or defects in iron or steel castings, having the same color and appearance. Made in powder form for use by foundrymen as a putty. Two grades, A and B.

### SMOOTH-ON JOINTS No. 5

This is an Iron Caulking Cement for bell and spigot cast iron soil and greenhouse pipes to be used in place of or in combination with caulking lead.

### SMOOTH-ON RIVET IRON CEMENT No. 6

This is a Metallic Cement for making water-tight joints on ship's sides, iron, steel or wood, bridge work, construction work, metal skylights and vault lights. Withstands temperature changes and salt water. Prepared and sold in putty form.

### SMOOTH-ON IRON CEMENT No. 7

This is a hydraulic Iron Cement, prepared and sold in powder form. For waterproofing concrete surfaces, brick surfaces, stopping leaks in concrete walls, floors, roofs and for bonding concrete. Apply alone or in combination with Portland cement.

### SMOOTH-ON CORRUGATED METAL GASKETS

Smooth-On Gaskets are made from sheets of specially prepared metal, rolled with concentric corrugations and then coated with one application of Smooth-On Elastic Iron Cement. They are the best gaskets for flanged joints, for any pressure or temperature, for steam, water, fire, oil, air or ammonia.

Smooth-On Cements are sold only in tin packages.

## BRUNSWICK REFRIGERATING CO.

NEW BRUNSWICK, N. J., U. S. A.

REFRIGERATING AND ICE MAKING MACHINERY

For Private Residences and Estates.

MARINE REFRIGERATING AND ICE MAKING PLANTS.

COMPLETE PLANTS INSTALLED FOR COMMERCIAL REFRIGERATION OF ANY KIND

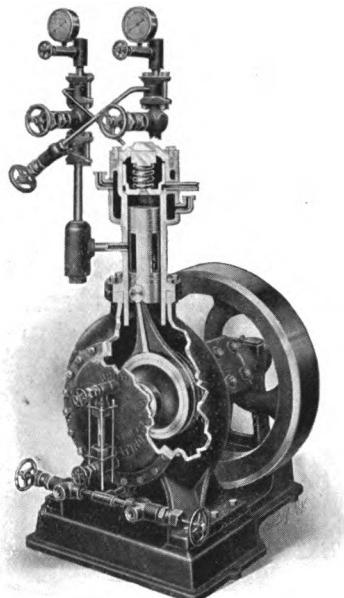
### CONSTRUCTION

The "BRUNSWICK" is constructed throughout for maximum strength, efficiency, and durability. For private residence work the "BRUNSWICK" is acknowledged to be the most successful type on account of these features and its simplicity.

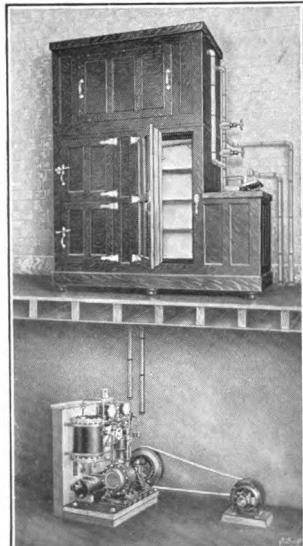
The COMPRESSOR is fool proof. Note the eccentric drive; the double set of piston rings; the safety relief valve inside of the discharge valve; the fact that the discharge valve is the full diameter of the cylinder. There is not a bolt or a nut inside of the crank case of the machine.

### THE "BRUNSWICK" SYSTEM

"BRUNSWICK" experience has improved not only the compressor, but the whole system from the automatic expansion valve which is used on the smaller units through the expansion



side of the plant, through the compressor, condenser, and back to the ammonia receiver. Nothing but the very best and strongest material is used. The fact that there are nearly 1,200 "BRUNSWICK" plants in operation today of 12 tons refrigerating capacity and less, 1,000 of which are under 6 tons capacity, is the best testimony that can be given regarding design, material and workmanship.



### APPLICATION

RESIDENCES	Confectioners
STEAMSHIPS	Dairies
Clubs and Cafes	Ice Cream Makers
Office Buildings (ice water)	Butchers
Hotels	Etc., Etc., Etc.

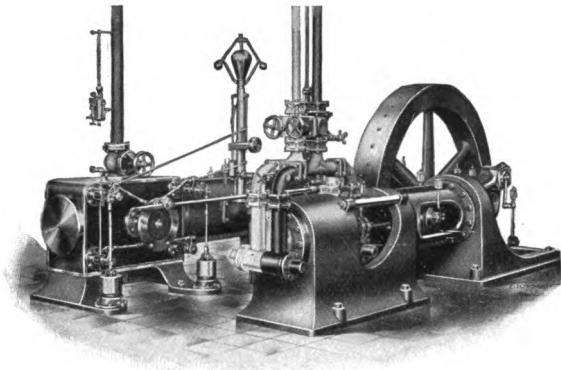
Send for list of residence installations. Send for list of steamships equipped with "BRUNSWICK" plants, or for general list of installations of all kinds.

The "BRUNSWICK" motto is not "Build the cheapest machine," but "Build the best." Our specialty is the small unit.

## THE HUETTEMAN &amp; CRAMER CO.

DETROIT, MICH.

## REFRIGERATING AND ICE MAKING MACHINERY



The "Safety" Ammonia Compressor

## FEATURES OF ADVANTAGE OF THE "SAFETY" REFRIGERATING MACHINE

This machine is designed to minimize the possibility of wreck or damage caused by a valve part or by liquid becoming imprisoned between cylinder and piston.

Due to the peculiar location of the compressor suction and discharge valves it is impossible for any valve part in case of breakage to enter the cylinder, and any shot of liquid that may come through the suction pipe will be forced out through the discharge valves, before the piston reaches the end of its stroke.

The machine is designed along the most improved and up-to-date lines, being of heavy duty construction throughout, and on account of being built horizontal it can be readily looked after and adjusted; also because of being made in sections, which in addition eliminates undue strains that exist in all large castings, it will permit of being installed in close quarters and in out of the way locations.

All working parts are provided with large wearing surfaces, every means of adjustment is provided, all these being readily accessible, and improved oiling devices are fitted to all wearing surfaces.

Because of its simplicity, accessibility and ready adjustment, it can be placed in charge of any average engineer with best results.

These machines are built for direct connection with engine or to be belt driven.

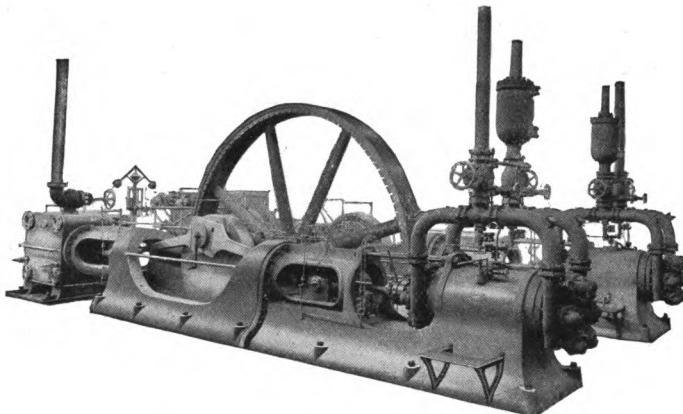
## CAPACITIES IN TONS OF REFRIGERATION SIZES APPROXIMATE SPEEDS AND POWER REQUIRED

Tons Cap...	6½	8	9	11½	15	25	30	40	45	50	60	65	80	90	100	115	145	160
Bore .....	5½	6½	6	7	8	9	10	11	11½	12	13	13½	14	15	16	17	18	19
Stroke .....	12	12	14	14	16	18	20	22	22	24	26	26	30	30	32	32	36	36
R.P.M. ....	90	90	85	85	80	80	75	75	75	70	70	70	65	65	60	60	60	60
Appr. H.P..	10	14	15	18	25	40	45	60	65	75	90	100	120	135	150	175	220	240

# THE VILTER MANUFACTURING CO.

MILWAUKEE, WIS.

CORLISS ENGINES, COMPLETE POWER PLANTS.  
REFRIGERATING AND ICE MAKING MACHINERY,  
BREWERS' MACHINERY, BOTTLERS' MACHINERY



Duplex Ammonia Compressor driven by Cross Compound Corliss Engine

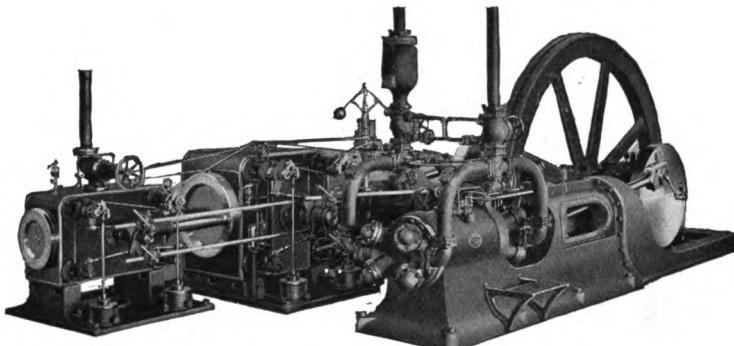
## CORLISS ENGINES

Vilter Corliss Engines are equipped with an improved releasing gear giving high economy in steam consumption and reducing the wear on the reciprocating parts. They are of the horizontal type, built in all sizes from 25 H.P. up and furnished with either Girder, Heavy Duty or Rolling Mill Type Frames to suit individual load conditions and steam pressures. They are either Simple, Tandem or Cross Compound, condensing or non-condensing.

Excellent results are obtained where our Corliss Engines are used to drive our double-acting ammonia compressors. They are also admirably adapted for driving air compressors. For driving direct connected electric generators at higher rotative speeds the only change necessary is to equip them with our high speed, close-regulating governors.

All the refinements necessary to meet the exacting demands of modern steam engineering practice in a prime mover of this kind are incorporated in our designs. Steam and exhaust valves are double-parted and our cylinder castings are constructed with a single passage for the admission and exhaust at each valve. Cylinder clearance is reduced to a minimum. The steam and exhaust valve mechanisms are driven by either single or double eccentrics, the latter permitting a longer range of cut-off and greater overload capacity. Every part of our engine is designed with the idea of improving its mechanical efficiency and of giving the highest economy in every day operation.

# THE VILTER MANUFACTURING CO.



Ammonia Compressor driven by Tandem Compound Corliss Engine

## AMMONIA COMPRESSORS

Our ammonia compressors of the horizontal double-acting type are built in consecutive cylinder sizes ranging from 6" x 12" to 24" x 48". Sizes 13" x 26" and larger are also built in duplex units of from 125 tons to 750 tons refrigerating capacity. All sizes are steam driven by our direct connected Corliss Engines. They are also adapted for driving by belt or rope transmission.

The design of our compressors is remarkably free from complication and the construction is such that long life, satisfactory service and freedom from trouble is assured. Careful attention is given to exactness of workmanship during the building of our compressors, and no detail of construction, however slight, passes inspection unless the workmanship is up to standard.

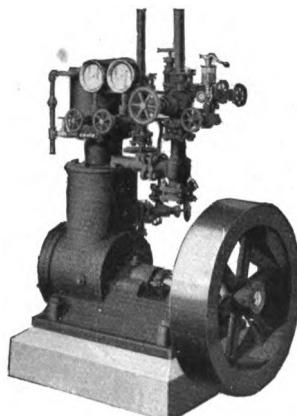
The cylinder and piston construction have special merit. The piston takes the form of an elongated sphere, presenting a large bearing surface to the cylinder walls. The cylinder heads are finished in conformity with this design and are turned to a true half sphere to conform to the shape of the piston, resulting in maximum strength and very small clearance spaces. This construction also gives the largest attainable valve area and permits the use of multiple suction and discharge valves in each cylinder head.

Every detail of our construction is fully described and illustrated in our bulletins, which we shall be glad to send to those interested.

## SMALL BELT-DRIVEN SINGLE-ACTING COMPRESSORS

Our small vertical single-acting ammonia compressors are of the enclosed type, arranged for belt connection to an electric motor, gas or gasoline engine, line shaft, or small steam engine. They are designed with particular attention to the requirements of users of small ice-making and refrigerating plants. The fewest possible number of units and rigid construction insures perfect alignment and the least amount of wear on the moving parts. Particular attention has been given to the matter of automatic lubrication, accessibility for inspection and adjustment, and elimination of every troublesome element.

We are prepared to furnish this type of compressor in the following cylinder dimensions, viz: 4" x 6", 5" x 6", 6" x 8", 7" x 8", 8" x 9" and 9" x 9" and to furnish full information relative to each size. These compressors are rated at from one to fifteen tons refrigerating capacity and are also furnished in duplex units with a single belt wheel.



Vertical Enclosed Type Single-Acting Ammonia Compressor for Belt Drive

## UNION FIBRE COMPANY

WINONA, MINNESOTA

**WATER-PROOF LITH, UNION CORK BOARD, FOR INSULATION OF COLD STORAGE PLANTS, BREWERIES, ICE HOUSES, ETC.; LINOFELT FOR REFRIGERATOR CARS, ICE HOUSES, ETC.**



**WATER-PROOF LITH** is an insulating board made of Patent Water-proof Rock Wool and Degummed Flax Fibres. It is furnished in the form of a board which can be handled and sawed like lumber. These boards are exactly 18" x 48" in area, and of any thickness from one-half inch to three inches.

It is claimed that, as compared with other insulating materials, Water-proof Lith offers important advantages as follows:

- First —It has highest efficiency as a non-conductor.
- Second —It is strong and easily handled.
- Third —It will sustain considerable weight.
- Fourth —It will not disintegrate.
- Fifth —It is uniform in composition.
- Sixth —It will not absorb moisture and has no capillary attraction.

The usual method of applying Lith in brick or concrete buildings is to set up the boards either in one, or preferably two, layers, coating each board with a water-proof compound, and on the interior surface of the room covering the insulation with Portland Cement Plaster. Frequently each course is imbedded in Portland Cement Plaster against the wall in the same manner that tile are erected.

**UNION CORK BOARD** is composed of the best quality of pure granulated cork, each granule being treated at a high temperature and then instantly coated with a special water-proof mixture, then moulded into sheets and sawed to dimensions. Each granule of cork retains its full insulating value and each one is water-proof.

Union Cork Board is not burned in the process of manufacture, neither is there any compression applied to the boards beyond that which is necessary to make a close union of all particles.

Cork Boards are erected for the purposes of insulation just like Water-proof Lith Boards described above.

**LINOFELT** is a quilt insulation of degummed flax fibre manufactured by a special patent process from flax straw. The flax fibre is stitched between two thicknesses of 90-lb., 3-ply black water-proof paper to make the completed article, Linofelt.



**FETTLINO** is an insulating board made of selected flax fibre, strong, light of weight and high insulating value. The boards are 3 feet wide, 8 feet long and of any thickness from  $\frac{1}{4}$  inch to  $1\frac{1}{2}$  inches.

Linofelt and Fettlino are both widely used for insulating refrigerators. These two forms of insulation are adapted to ice houses and other wooden structures where low cost is essential.

The Union Fibre Company maintains a Construction Department and contracts to erect its insulation in any place. This Department has for the benefit of engineers data with regard to insulation and sketches of the different methods of application to overcome particular problems. Any of these will be sent to engineers free upon request. The company also issues booklets descriptive of its insulation, and furnishes samples upon request.

## THE A. & F. BROWN CO.

ENGINEERS, FOUNDERS, MACHINISTS AND MILLWRIGHTS

172 FULTON STREET,  
NEW YORK CITY

WORKS

ELIZABETHPORT, N. J.

MANUFACTURERS OF GEARS OF ALL DESCRIPTIONS, TURNED STEEL  
SHAFTING, PULLEYS, SPLIT PULLEYS, FRICTION CLUTCHES, SPECIAL  
MACHINERY, ETC.

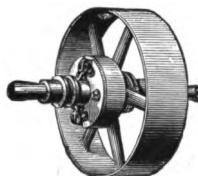
### CUT GEARS

These gears are cut on the best up-to-date automatic machines obtainable, enabling this department of the shops to turn out accurately cut gears of every description and size.



### MACHINE MOULDED GEARS

The Gear Department of our foundry is fitted up with the most modern gear moulding machines, enabling us to furnish machine moulded gears up to 16 feet diameter, and 25 tons in weight if in one piece, and heavier if split, or built up. These gears are much more accurate than ordinary cast gears and are of the toughest mixture of iron.



### FRICTION CLUTCHES

The F. Brown Friction Clutch is simple, compact and having few small parts is not liable to get out of order; engages gradually and when thrown "in gear" has a stronger grip than any other, owing to the large friction surfaces and powerful operating device which is a combination of double ended (or right and left thread) screw and toggle joint.

### SIRENS

These fog signals are used by the United States Navy and Light-house Departments, also by a number of foreign governments and many steamships. They are also in use as fire alarm signals in small towns and large manufacturing plants.

### COGSWELL MILL

The problem of grinding or pulverizing many materials has been successfully solved by this machine.

### SPECIAL MACHINERY

These shops are particularly well equipped for building special machinery to plans and specifications. The pattern shop, foundry and machine shops are strictly up-to-date in all particulars and equally well equipped to turn out work of the heaviest character as well as light machinery requiring first class material and workmanship and most modern tools.

Established 1854.

Incorporated 1898.

## THE FALK COMPANY

MILWAUKEE, WISCONSIN

MANUFACTURERS OF PRECISION HERRINGBONE GEARS  
WITH STAGGERED TEETH

(Wuest Patents)

We manufacture a complete interchangeable system of herringbone gears, with teeth generated on special machines, designed and built exclusively for our own use.

The gears which we produce are hobbed, both sides at once, in solid blanks.

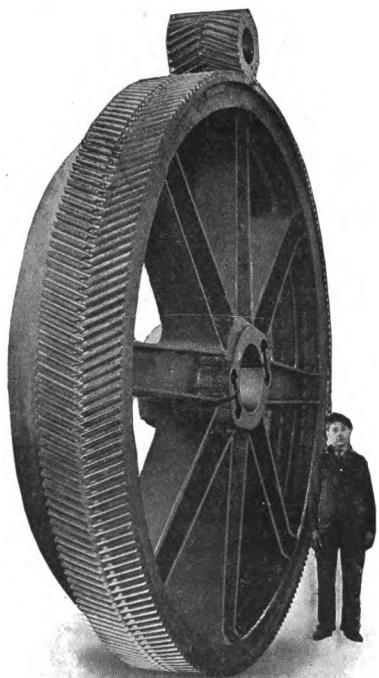


Fig. 1

gears can be run with safety at far higher velocities than the spur type. Special gears for use in connection with steam turbines are suitable for speeds up to 7000 feet per minute.

Referring to the illustrations, Figure One shows a combined Steel Gear and Clutch Drum for double drum hoist at a Michigan Iron Mine.

The steel gear rings and solid forged pinions in Figure Two represent a type of high ratio drive adapted for use with conical and straight tube mills.

Figure Three shows the type used for steam turbine and high velocity work, with fine pitch and relatively wide face.

**THE FALK COMPANY**  
MILWAUKEE, WISCONSIN  
**MANUFACTURERS OF PRECISION HERRINGBONE GEARS  
WITH STAGGERED TEETH**  
(Wuest Patents)

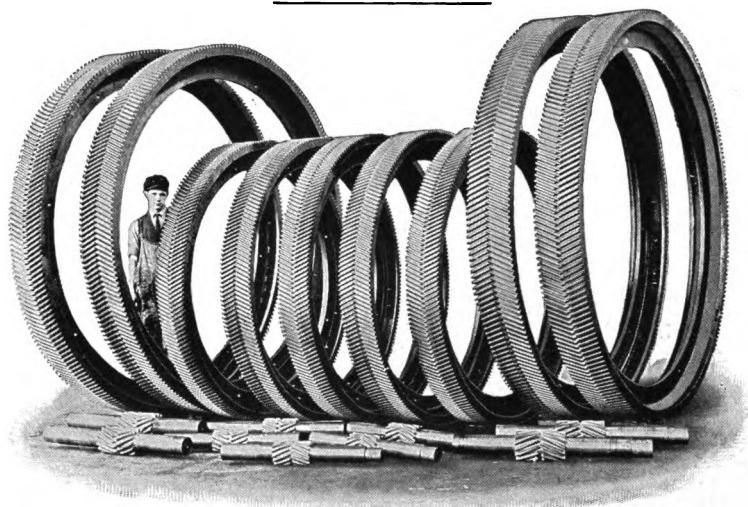


Fig. 2

**SPECIAL ADVANTAGES**

Long life.

High efficiency (loss never exceeds 1% at rated load).

Elimination of countershafts and double-gear trains.

Absence of vibration with prevention of shaft-crystallization and breakdown of motor insulation.

Quiet action with durable steel pinions.

The range of application for Wuest herringbone gears covers every case where spur gears are used and many new fields where spur gears are impossible.

Specially adapted for

Marine Steam Turbines.

Turbo-Generators.

Turbine-driven centrifugal pumps,  
mills and shafting.

Rolling Mills and Rod Mills.

Tube Mills and Crushing Plant.

Power Pumps.

Air Compressors and Blowers.

Hoisting, Elevating and Conveying  
Plant.

Rubber Machinery.

Machine Tools.

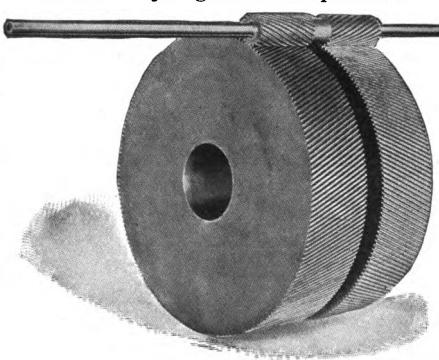


Fig. 3

# DODGE MANUFACTURING COMPANY

## MISHAWAKA, INDIANA

### Branch Sales Offices and Warehouses

Chicago  
Boston

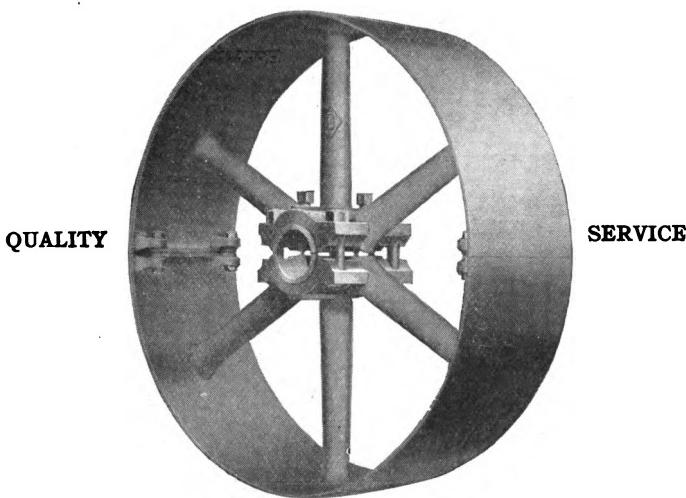
New York  
Brooklyn

Philadelphia  
St. Louis

Pittsburg  
Minneapolis

Cincinnati  
Portland, Ore.

### "STANDARD" SPLIT IRON PULLEYS



Standardized and Interchangeable

When a practical mill or factory man buys metal pulleys he naturally wants the best he can get—pulleys that will hold fast, run true, stay round, carry the load and last a lifetime.

He wants these pulleys in a hurry too, wants them split, so that they can be mounted without taking down the shafting or stripping it of other equipment.

The Dodge "Standard" split iron pulley fills these requirements. It is cast whole, then split by cracking the rim at parting line between the rim lugs. When clamped on the shaft the fractured edges are brought together by the rim bolts so that the pulley practically becomes a solid pulley.

It is fastened to the shaft by compression on interchangeable bushings and this fastening is anchored by two set screws.

No other piece of machinery is subjected to the constantly shifting strain that a pulley receives, consequently a good pulley must contain unusual resisting qualities. In metal pulleys this is best secured by integral construction of the halves. Riveted or bolted structures of flexible materials do not contain the mechanical elements that insure safe, positive driving power or durability of parts.

Designed for stock purposes, a dealer is able to deliver from his store a pulley which has heretofore only been supplied at great expense and delay, and almost universally of a design far from satisfactory to the customer.

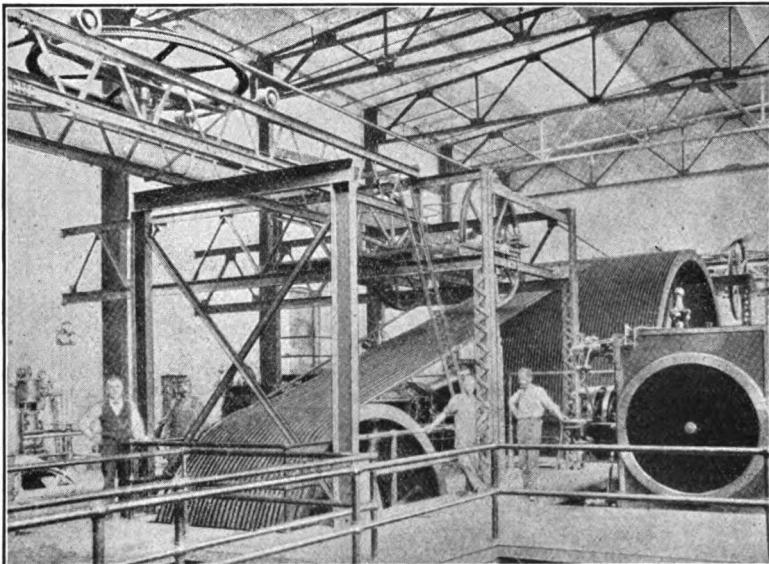
# DODGE MANUFACTURING COMPANY

## MISHAWAKA, INDIANA

### Branch Sales Offices and Warehouses

Chicago	New York	Philadelphia	Pittsburg	Cincinnati
Boston	Brooklyn	St. Louis	Minneapolis	Portland, Ore.

### AMERICAN SYSTEM OF ROPE DRIVING



A 1500 H.P. Rope Drive Showing Arrangement and Material—All Dodge

Among noteworthy contributions to progress in the engineering world it is conceded that none has been of greater importance or of more far-reaching influence than the American, or continuous wind system of rope driving. Originated and patented under the name of Dodge in 1883, the improvement over the English or individual rope driving system was so marked that it soon developed into a most valuable mechanical device, and is so recognized today.

For vertical driving, main engine drives and drives involving distance or angles, this system has shown its efficiency and durability. In general service it is positive in delivery of power, low in first cost, noiseless and flexible, and never cumbersome. Slippage is practically eliminated and general friction reduced to a minimum.

In the English system when the rope travel exceeds 5,000 r.p.m. there is a marked decrease in efficiency, due to centrifugal force; in the American system this is overcome by the automatic tension device.

Backed by twenty-five years of active practice and experience as engineering specialists, we are in a position to secure the best results, and realize the greatest success in the solution of transmission problems and in the design and manufacture and installation of equipment for driving purposes.

Continued on following pages

## *Water Softener and Purifier*

# DODGE MANUFACTURING COMPANY

MISHAWAKA, INDIANA

Jranch Sales Offices and Warehouses  
Chicago      New York      Philadelphia      Pittsburgh      Cincinnati  
Boston      Brooklyn      St. Louis      Minneapolis      Atlanta      Portland, Ore.

### "EUREKA" WATER SOFTENER AND PURIFIER



SAVES FUEL

SAVES WORK

SAVES BOILERS

SAVES MONEY

Machine as it appears in use

The Dodge Eureka Water Softener and Purifier solves the most difficult problems of economical power plant operation by providing boilers with pure, soft feed water. It was added to the Dodge line only after a thorough test.

The machine automatically treats and purifies the water before it enters the boiler. It is impossible for scale to form under this process. Boiler tubes are always clean. They will not pit, corrode or explode, and the life of the boiler is greatly prolonged.

One concern using the Eureka reported a saving of 20 per cent and another 10 per cent. At Mishawaka the apparatus has cut down fuel bills about 15 per cent, and in addition a vast amount of work, wear and tear on boiler room equipment is done away with. The saving, of course, depends largely on conditions; but we make the Eureka fit conditions.

The machine requires only about one-half hour's attention every working day, and there is practically little cost attached to operation, after first installation.

We have a complete laboratory for analyzing feed waters. Send us a sample of the water you are using for investigation.

To supply the demand for literature dealing with softening and purifying water, we have issued a special number of The Dodge Idea. Send for it.

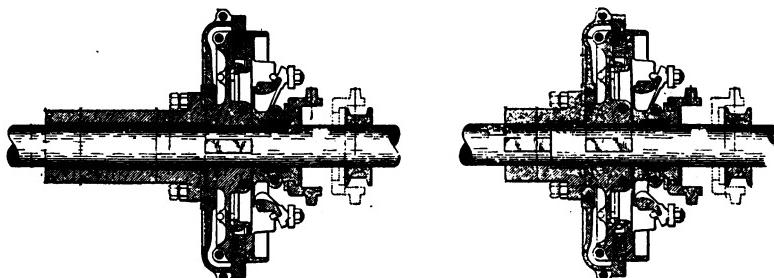
# DODGE MANUFACTURING COMPANY

## MISHAWAKA, INDIANA

### Branch Sales Offices and Warehouses

Chicago	New York	Philadelphia	Pittsburg	Cincinnati	Boston
Brooklyn	St. Louis	Minneapolis	Atlanta	Portland, Ore.	

### SPLIT FRICTION CLUTCHES



Sectional Views of Dodge Split Friction Clutch

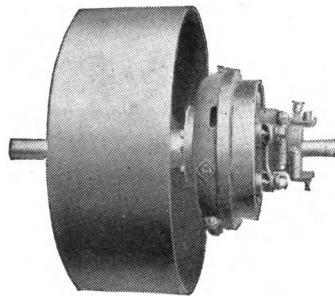
The Dodge Split Friction Clutch is practically adapted for high speeds and severe duty. Being split it is applicable to shafting without disturbing balance of equipment, thus facilitating repairs and renewals.

The principal feature of this clutch is its wonderful frictional power, obtained through an outside disc into which are driven hard maple blocks presenting end grain, an inside driving plate which is keyed to the shaft, and an outside driving plate attached to inside driving plate and levers. By movement of levers the driving plates are brought in contact with the wooden blocks, thus transmitting the power to sheave or hub if it be a coupling. The detachable sleeve allows the use of any type of sheave, pulley, gear or sprocket; the clutch may be used for clutch pulley, cut-off coupling or quill outfit. It saves power, reduces danger of accident, gives individual and quick control and conforms to all the new factory laws.

We also make a solid clutch for moderate units of power for either slow or high speed. It can be applied to stationary or portable machine tools and counter-shafts, pulleys, gears, etc.

In the selection of a clutch, a steady load is the only basis upon which the proper rating can be made.

The safest way is to get quotations on your requirements. In writing for prices state power to be transmitted, speed of shaft, diameter of shaft, diameter and face of pulley and space available on shaft.



Dodge Split Friction Clutch in Combination with Split Iron Pulley

# FALLS CLUTCH & MACHINERY CO.

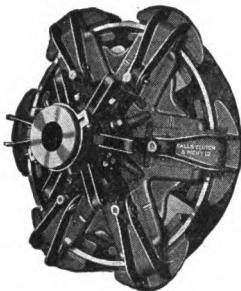
CUYAHOGA FALLS, OHIO

NEW YORK  
206-208 Fulton Street

BOSTON  
52-54 Purchase Street

CINCINNATI  
134 W. Second Street

PULLEYS, SHAFTING, HANGERS, PILLOW BLOCKS, COUPLINGS, COLLARS,  
FRICTION CLUTCH PULLEYS, FRICTION CLUTCH COUPLINGS, AND ALL OTHER  
POWER TRANSMITTING MACHINERY.



## FALLS FRICTION CLUTCH COUPLINGS, PULLEYS, GEARS AND ROPE SHEAVES

Gripping shoes being wood are easily replaced. Parts interchangeable, simplicity of adjustment, made for twenty years, thoroughly tried out. Friction clutch pulleys with interchangeable babbitt or bronze lined sleeves. All parts accessible. High starting torque.

There is absolutely no contact of frictional surfaces when not "in clutch." All our clutch pulleys are furnished with split cast sleeves for bearings, which are babbitted with the best quality of metal, turned on the outside to fit the hub of the pulley and bored on the inside to fit the shaft, thus making a very complete bearing. The sleeves are held in position by means of

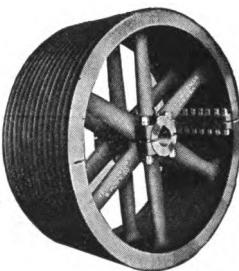
two cap screws, and when the babbitt is worn they can be readily taken out, rebabbitted and placed in position again without removing the pulley from the shaft.

## FALLS SYSTEM OF ROPE TRANSMISSION

Owing to the flexibility of rope transmission, it has been generally recognized by engineers to be the best mechanical means of power distribution. A few of the many advantages are that the location and position of driving shaft from driven shaft does in no way prevent the use of same; the amount of power being unlimited; economy in first cost and maintenance being the initial features.

Other features equally important: steady running, noiseless, without electrical disturbance, and no loss of power by slipping. Power may be transmitted with rope by two distinct methods: as by the multiple or English system, and by the continuous or American system.

We supply complete equipment, including sheave wheels, tension carriages, etc., and will design and estimate for any contemplated installation.



## PULLEYS

Are made from Grey Cast Iron, have Straight or Crown Faces, either solid or split, for double and single belts, turned true and accurately balanced.

Our Steel Rim Pulleys have a Cast Iron Spider and rim, with an adequate steel rim securely riveted to same, which, in turn, is ground true and accurately balanced, are light and strong, made both split and solid, adapted for high speed service.

# THE CARLYLE JOHNSON MACHINE COMPANY

MANCHESTER, CONN., U. S. A.

## THE JOHNSON FRICTION CLUTCH

A Small, Compact Clutch for Light Power



Single Clutch-Exterior



Double Clutch-Exterior

### DIMENSIONS OF STANDARD SINGLE CLUTCHES

Clutch Size Number	Horse-power for each 100 R.P.M.	Largest Diameter of Clutch will Bore	Throw D to Engage Clutch	Weight of Standard Clutch
2	2	1 $\frac{7}{16}$ "	1 $\frac{1}{16}$ "	12 lbs.
4	3	1 $\frac{11}{16}$ "	1 $\frac{1}{16}$ "	19 "
5	4	1 $\frac{13}{16}$ "	1 $\frac{1}{16}$ "	27 "
6	5	2 $\frac{3}{16}$ "	1 $\frac{1}{8}$ "	35 "
8	6	3"	1 $\frac{1}{16}$ "	53 "

### DIMENSIONS OF STANDARD DOUBLE CLUTCHES

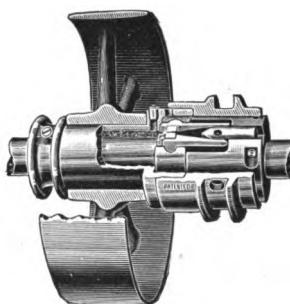
Clutch Size Number	Horse-power for each 100 R.P.M.	Largest Diameter of Clutch will Bore	Throw D to Engage Clutch	Weight of Standard Clutch
2	2	1 $\frac{7}{16}$ "	1 $\frac{1}{16}$ "	25 lbs.
4	3	1 $\frac{11}{16}$ "	1 $\frac{1}{16}$ "	32 "
5	4	1 $\frac{13}{16}$ "	1 $\frac{1}{16}$ "	43 "
6	5	2 $\frac{3}{16}$ "	1 $\frac{1}{8}$ "	54 "
8	6	3"	1 $\frac{1}{16}$ "	96 "

### CONSTRUCTION

As seen by the illustration, this type of Clutch has but few parts and is very compact. A body fastened to the shaft carries a split ring in which are inserted a pair of levers. A curve-shaped wedge, which is made part of a shipper sleeve, forces the levers apart, expanding the ring, bringing its outer surface into frictional contact with the inner surface of the friction cup, the hub of which is made to suit requirements.

The leverage is so compounded that it requires but little pressure to operate the Clutch.

One screw which moves two taper blocks, set into the levers, adjusts the contact of the ring and cup to any tension. This is easily reached with a screwdriver through hole in the friction cup. The perfectly smooth shipper sleeve entirely covers the working parts so no dirt can get near them. The Double Clutch requires but little more space than the Single, and has two friction cups with hubs, on which can be mounted pulleys, cones, gears, etc., of any diameter and face.



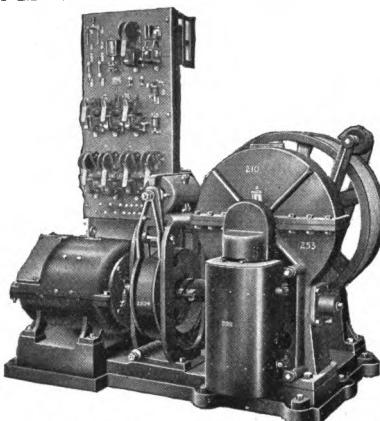
Section Broken Away, Showing Clutch Engaged and Pulley Mounted on Hub of Friction Cup

## THE EASTERN MACHINERY CO. NEW HAVEN, CONN.

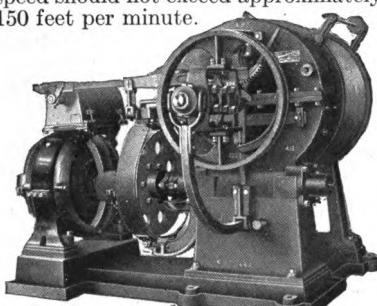
### PASSENGER AND FREIGHT ELEVATORS

#### DIRECT CONNECTED ELEVATOR MACHINE AND CONTROLLER

For first-class elevator service at high or medium speeds, for either passenger or freight work, winding machines operated by full magnet control from switch in car are the most convenient, satisfactory and safe. They may be operated with direct current or alternating current. Where direct current is provided the machines can be arranged for two-speed operation. They can be built to handle a heavy load at a slow speed and a light load at a high speed. Or the slow-speed provision may be applied for convenient acceleration at the start and making stops easier and more accurate. Where alternating current is provided they cannot be satisfactorily arranged for two-speed control, and the car speed should not exceed approximately 150 feet per minute.



Direct Connected Elevator Machine and Controller for Car Switch or Automatic Push-Button Control



Direct Connected Electric Elevator Machine for Shipper Rope Control

#### SINGLE BELT ELECTRIC ELEVATORS

This type of Elevator is especially useful for freight service and where car speed is not over 70 feet per minute. The operating parts consist of the usual worm gear winding machine driven with one belt from a compound wound reversing motor which runs only when the elevator is in motion. Either direct or alternating current motors built for the current in use may be employed.

Electric elevators of this type are less expensive than those with direct connected winding machines, and give very satisfactory service.

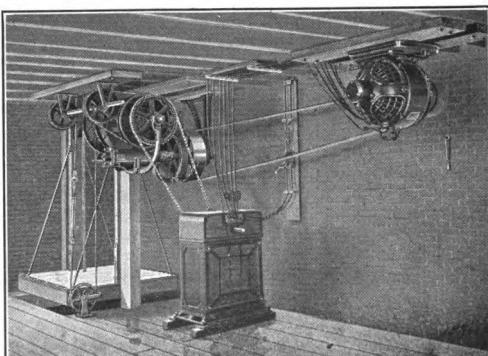
#### DIRECT CONNECTED ELECTRIC ELEVATOR MACHINE

For Freight or Passenger Service with Shipper Rope Control

This machine is designed for moderate speed passenger or freight service and arranged to be controlled by shipper rope passing through well hole, with or without wheel operating device in car as may be desired.

Either direct current or alternating current motors may be used, wound for any standard voltage.

This type of machine is also made compound geared, with single or double drum.



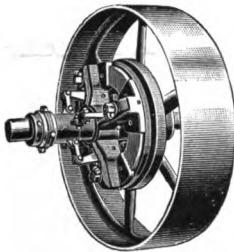
Single Belt Electric Elevator

# THE EASTERN MACHINERY CO.

NEW HAVEN, CONN.

FRICITION CLUTCHES AND CUT-OFF COUPLINGS. FRICITION CLUTCH PULLEYS.  
FRICITION WINDING DRUMS.

## THE FRISBIE PATENT FRICTION CLUTCH PULLEYS



Single Pulley with  
Link Sleeve Friction

These pulleys operate in a perfect manner on all machinery moved by wheels, without loss of power, with no end thrust on the shaft, run without noise, and very little wear. They do away with all shifting of belts on tight and loose pulleys. They are simple in construction, readily understood and easy to adjust. They are equally good for high speed or low speed shafting, for heavy or light work. The variety of application is entirely unlimited and they are a source of profit wherever used.

They are in successful operation on countershafts and line shafts in factories of all descriptions. They are in use in rubber mills, brass mills, iron rolling mills, electric light stations, cotton mills, bleacheries, grain elevators, coal elevators, etc., etc.; on mining machinery, pile drivers, brick machinery.

We make no pretensions for our clutches that cannot be justified by their record. They do not vary from a uniform grade of excellence in construction, their superior standing being maintained by continued effort and well tested improvements. Each part is finished to templates or jigs in a first-class manner and each part interchangeable.

### CONSTRUCTIONAL FEATURES

The pulley runs loose on the shaft with a renewable bushing through the hub, which takes all the wear.

The V friction ring is cast onto the arms of small pulleys, as shown in the views, and bolted onto the larger ones. The system of levers in the clutch spider, which is keyed solidly to the shaft, together with the friction shoes inside the ring, form the operating mechanism.

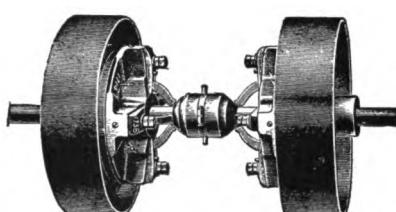
Movement of the sliding sleeve operates the latches which move the heavy dogs, and by means of the shoe bolts draws the four friction surfaces of the pulley and spider together in positive and powerful contact.

The leverage being great, only a few pounds' pull is required on the sleeve to exert enormous pressure on the friction surfaces.

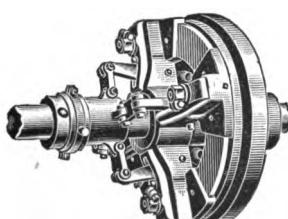
The amount of pressure is regulated by the clamp nuts on the shoe bolts, which also take up lost motion caused by wear. Notice that there are four friction surfaces and consequently a much more powerful friction grip than with other clutches.

The shoes and spider are shot with thoroughly seasoned maple. End thrust on the shaft, so often noticed on other clutches, is also entirely eliminated.

We have on hand at all times a complete stock of the smaller parts of our clutches and make a special point of quick deliveries.



Pair of Friction Pulleys with  
Double Cone Sleeves



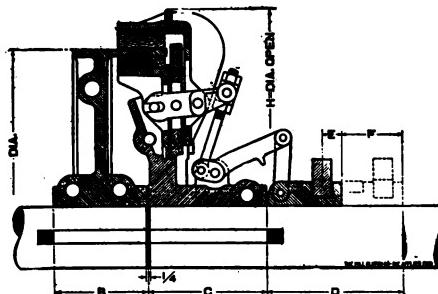
Cut-Off Coupling

# THE HILL CLUTCH CO.

CLEVELAND, O.

New York Sales Office, 50 Church St.

A COMPLETE LINE OF POWER TRANSMISSION MACHINERY FOR BELT AND ROPE DRIVES, INCLUDING THE WELL KNOWN PATENTED HILL FRICTION CLUTCH (SMITH TYPE) AND COLLAR OILING BEARINGS, BRIEFLY DESCRIBED BELOW.



The Smith Type of Hill friction clutches are built in 19 sizes ranging in capacity from 9 to 1300 horse power at a 100 R. P. M., and have 3, 4 and 6 arms according to their capacity. The friction surfaces are wood against iron, which is a combination offering great frictional resistance and the shoe area is exceptionally large. The action of the clutch mechanism is positive, no springs being used. The sectional view shows the toggle connection from the cone to the jaws, which positively releases, as well as engages the friction surfaces.

A noteworthy feature in the design of this clutch is that any working part, including the inside jaws, may be removed parallel to the shaft from the mechanism side. This can be done without disturbing the main spider casting or pulley, as bolted gib guides secure the inner and outer jaws to the spider as shown in the illustration. The clutch pulleys are mounted upon split removable sleeves, babbitted or bronze lined as specified, which can readily be replaced without disturbing the pulley or clutch.

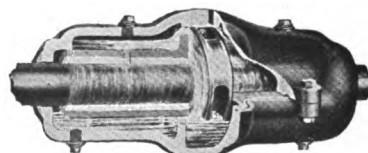
## HILL COLLAR OILING BEARINGS

In the Hill Collar Oiling bearings instead of depending upon a loose ring or chain for conveying oil to the journal, a fixed collar is employed.

Oil stored in large reservoirs in the bottom of bearing is continuously and positively elevated to the top reservoirs by the means of a heavy split collar clamped to the shaft. From the upper reservoirs the oil flows by gravity over the entire bearing surface.

Three or four revolutions of the shaft and the bearings are flooded.

It is not only in the positive and copious means of oiling that the Collar Oiling bearing gains in efficiency, for the collar also serves as a thrust collar and operates in a bath of oil and thrusts against babitted seats. On this account no outside collars are required unless the end thrust is extremely severe. All other types of bearings require outside shaft collars which bear against iron with no lubrication.



## THE METALINE COMPANY

Corporate name changed from  
NORTH AMERICAN METALINE CO.  
April 10, 1912

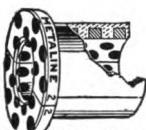
WEST AVE. NEAR BORDEN, LONG ISLAND CITY, N. Y.

### METALINED OR OILLESS BEARINGS AND BUSHINGS

Metaline is composed of metallic oxides and other substances reduced to an impalpable powder and then solidified in hardened steel moulds under great pressure into short length plugs  $\frac{1}{8}$  in.,  $\frac{1}{4}$  in. and  $\frac{3}{8}$  in. in diameter.

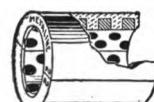
These plugs are inserted into holes drilled in divided bushings of gun metal bronze, phosphor bronze, or composition metal of good quality.

The two halves of the bushing having been soldered together and then ma-



Flanged Bushing for  
loose pulleys or for  
boxes having an end  
or collar bearing

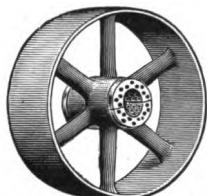
chined all over to specified finished dimensions, are separated and holes drilled into the bearing surface—not all the way through the wall of the bushing—into which the Metaline plugs are tightly fitted and then filed flush with the bearing surface, care being taken to see that the spacing of the plugs is such that they will overlap or break joints, particularly along the line of motion.



Plain Bushing for  
boxes or pulley  
block sheaves where  
there is no end  
bearing

"METALINE"  
(Trade Mark)

Registered in United States Patent Office, Act of Congress  
Approved February 20, 1905



Loose pulley after being  
fitted with a set of two  
metalined flanged  
bushings

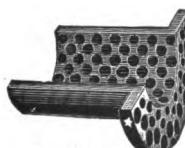
Bearings fitted with plugs of Metaline as described above are self-lubricating, being positively oilless; indeed no oil or other lubricant should be used.

It has been proved that they last for many years, and, if the Metaline plugs are renewed before over-much wear of the bearing surface has taken place, the life of the bushing or bearing will be very greatly prolonged.

Cleanliness is a very desirable feature, which with the elimination

of the danger of fire, a risk attending the use of fluid or semi-fluid lubricants in the other types of bearings, should particularly commend the use of Metaline.

It is conceded by the manufacturers that metalined bearings are not suitable for some lines of service; but it is claimed that these bearings give unusual

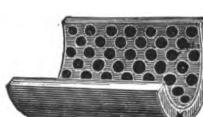


One-half flanged  
bushing

satisfaction for tackle blocks, wire rope and tramway sheaves, loose pulleys, friction clutch pulleys, idler and mule pulleys, elevator pulleys and other places where the bearing revolves around the shaft; line and counter shaft boxes, floor stand boxes, ventilating fans, small motor bearings, etc.



Sheave fitted with plain  
or unflanged metalined  
bushing

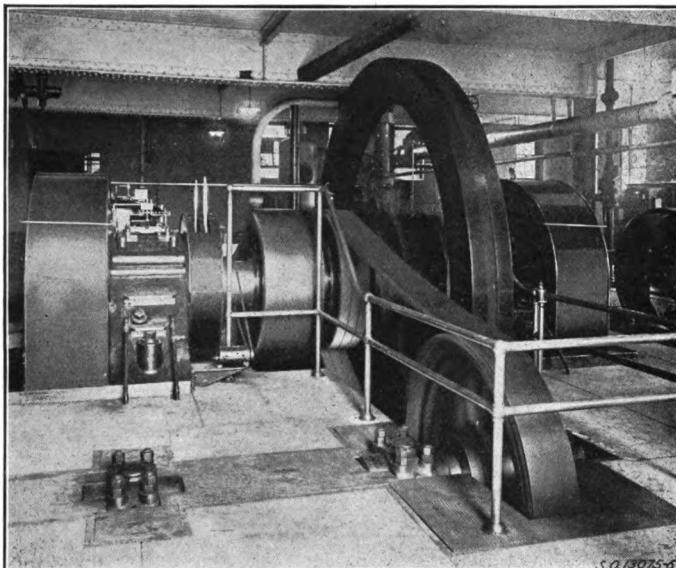


One-half plain  
bushing

## MORSE CHAIN COMPANY

ITHACA, NEW YORK

**MORSE SILENT RUNNING HIGH-SPEED CHAINS AND SPROCKETS**



The Morse Silent-Running Power Chain is essentially a steel belt made of flat links so shaped as to form teeth on one side of the chain, which engage with teeth cut in the sprocket wheel on which it runs.

It is used in place of belting or gears to transmit power for any purpose and is made in sizes varying from  $\frac{1}{2}$  H.P. at 3000 R. P. M. to 3000 H.P. at slow rotative speeds, an aggregate of over 500,000 H.P. being now in successful daily operation.

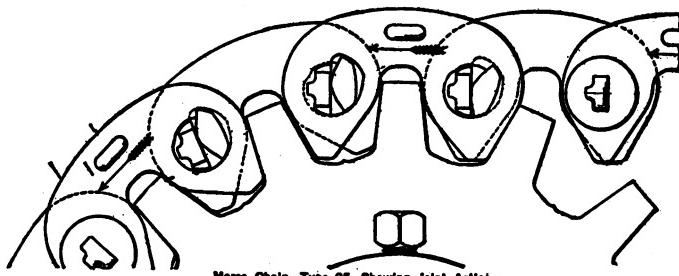
By its use power may be transmitted with a positive speed ratio on short centers, quietly and with an efficiency of nearly 99 per cent.

This high efficiency is due to the use of the Morse Frictionless Rocker Joint, which consists of two pins of hardened tool steel, each forming half of the joint and so shaped and held that as the chain bends, the rounded edge on one pin rocks upon the flat side of the other, thus substituting a rolling motion for the rubbing friction found in all other chain joints. When the chain is straight the flat seat pin bears against one of the flat faces of the rocker pin, so that it is only when the chain bends that the load comes upon the rounded edge of the rocker. This prevents undue vibration in the strands of the chain between the sprockets and reduces wear of the rolling base.

The chain should be lubricated with a heavy paste grease containing no solid matter.

The chains are made in a variety of widths to suit the power transmitted and in ten pitches, the number of revolutions of the smaller sprocket determining the pitch to be used, as shown by the following table:

(See next page)



Morse Chain, Type 23, Showing Joint Action.

### MORSE CHAIN AND SPROCKET DATA

PITCH	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{9}{16}$	$1\frac{1}{16}$	$1\frac{1}{2}$	2	3
Min. No. { Small Sprocket Driver... of Teeth { Small Sprocket Driven...	13 17	13 17	13 21	15 25	15 29	17 29	17 31	17 35
Desirable number of teeth in driver sprockets.....	15-17	17-21	17-21	17-23	17-23	17-27	17-31	19-31
Maximum number of teeth in sprockets. (See Note 3.).....	99	109	115	125	129	129	129	131
Desirable number of teeth in driven sprockets.....	55-75	55-75	55-85	55-95	55-105	55-115	55-115	55-115
To find pitch diameter of wheel multiply No. of Teeth by (inches).....	.159	.199	.239	.2865	.382	.477	.636	.955
Addendum. For outside diameter of sprockets 20 to 130 T. (See Note 1) (inches).....	.05	.06	.075	.09	.12	.15	.20	.30
Maximum R. P. M. ....	2400	1800	1200	1100	800	600	400	250
Tension per { Small Sprocket Driver.. inch width chain { Small Sprocket Driven.	80	100	120	150	200	270	450	750
Radial clearance beyond tooth required for chain (inches).....	0.50	0.62	0.75	0.90	1.2	1.5	2.0	3.0
Approximate weight of chain per inch wide, 1 foot long (pounds).....	1.00	1.20	1.50	1.80	2.50	3.00	4.00	6.00

Note 1. Number of teeth =T.

Exact Outside Dia.=D.

When T has less than 20 teeth, D =Pitch Dia.

When T has more than 20 teeth, D =Pitch Dia. +2 XAddendum.

Note 2. Use sprockets having an odd number of teeth whenever possible.

Note 3. When specially authorized, a larger number of teeth than shown may be cut in large sprocket.

Note 4. Thickness of sprocket rim, including teeth, should be at least 1.2 times the chain pitch.

Note 5. The number of grooves in the sprocket, their width and distance apart, varies according to pitch and width of chain. In every case leave the designing and turning of these grooves to the Morse Chain Company.

Note 6. The width of the sprocket should be  $\frac{1}{2}$  to  $\frac{1}{4}$  inch greater on small drives, and  $\frac{1}{4}$  to  $\frac{1}{2}$  inch greater on large drives than nominal width of the chain.

Note 7. An even number of links in the chain and an odd number of teeth in the wheels are desirable.

Note 8. Horizontal drives preferred with slack on top strand, but for short drives without center adjustment slack should be on the bottom strand.

Note 9. Adjustable wheel centers desirable for horizontal drives and necessary for vertical drives.

Note 10. Avoid vertical drives.

Note 11. Allow a side clearance for chain (parallel to axis of sprockets and measured from nominal width of chain) equal to the pitch.

Note 12. Desirable linear velocity for commercial service 1200 to 1600 feet per minute.

## NORDYKE & MARMON CO.

INDIANAPOLIS, IND

Estab. 1851.

### FLOUR AND CEREAL MILL MACHINERY, ELEVATING, CONVEYING AND POWER TRANSMITTING APPLIANCES

Although best known as manufacturers of Flour and Cereal Mill Machinery, the Nordyke & Marmon Co. are also large manufacturers of Elevating, Conveying and Power transmitting appliances. We present herewith a partial list of our products in this line, and a few illustrations to show the symmetrical and powerful lines along which they are designed.

Our general price list No. 1020 contains brief descriptions and complete tables of prices, dimensions and weights.

We also issue descriptive catalogues as follows: Roller Mills, Bolting Machinery, Book on Mills (Feed Mill Machinery), Packers, Blending Machinery, Rice Mill Machinery, Special Corn Mill Machinery, Starch Mill Machinery, and numerous circulars describing special machines.

We contract to furnish complete mechanical equipment for flour mills, corn mills, cereal mills, starch and rice mills, with or without power plant from the smallest to the largest capacities, furnishing detailed building and machinery plans.

A large and complete stock of mill supplies is carried from which orders are promptly filled.

We solicit inquiries for prices, estimates and information.

Attachments, sprocket chain

Bearings, double, eccentric, elevator boot, flange, flat, floor, floor stand, hanger, journal, pedestal, pillow block, post, rigid flat, rigid vertical, ring oiling, roll feeder, step, take-up, universal, upright, vertical

Belt clamps

Belt conveyor appliances

Belt tighteners

Belting, canvas stitched, cotton, leather, rubber  
Bevel gears

Boots, elevators—cast iron, galvanized iron, wood.

Brackets, wall

Buckets, elevator

Chain, sprocket

Clutches, friction, jaw

Cogs, wood

Collars, safety set

Conveyors, belt, flight, helicoid, spiral

Countershafts, variable speed

Couplings, clamp, cog, compression, conveyor, finger, flange, friction clutch, jaw clutch plate

Cups, elevator

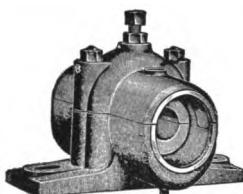
Elevators

Frames, sectional wall

Gears, bevel, spur, mitres, internal

Hangers, conveyor, drop, post

Hardwood conveyor flights



Ring Oiling Bearing

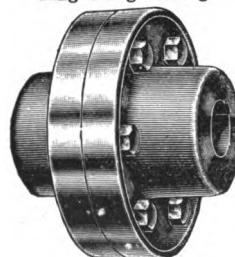
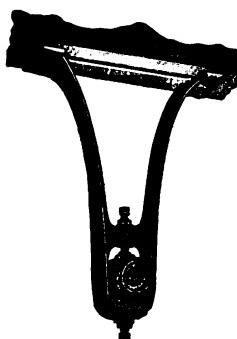


Plate Type Coupling



Adjustable Ball and Socket  
Drop Hangers

Double Brace, Ring Oiling  
Bearings

**NORDYKE & MARMON COMPANY**  
INDIANAPOLIS, IND.

Heads, elevator:  
galvanized iron,  
sprinkler, standard

Hoisting crabs

Hoisting cranes

Hoisting screws

Jacks

Keyseating

Laces, belt

Link belt

Link belt attachments

**Linings, conveyor**

Manila transmission rope

May-Oborn chain

Movers, car

Pillow blocks

Plates, anchor, arch leveling,  
pulley, sole or base, toe, tram

Post hangers, adjustable, double  
rigid

Power grain shovels

Pullers, car

Pulleys, cast iron, clamp hub, flanged, friction  
clutch, rope, solid, split, tight and loose

Rack tighteners

Rolls, belt conveyor

Rope, Manila transmission

Rope, sheaves

Rope, wire

Scales

Set screws

Shafting

Sheaves, rope, rubber filled

Speed indicators

Stands, floor, pulleys

Take-up boxes

Tension carriages

Tighteners, belt

Tracks for tension carriages

Triple conveyor bearings

Troughing rolls and carriers

Vertical shaft bearings

Wall box frames

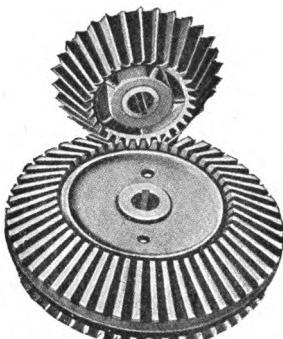
Weights for tension carriages

Wheels, sprocket

Wood boxes for conveyors

Wood shaft conveyor

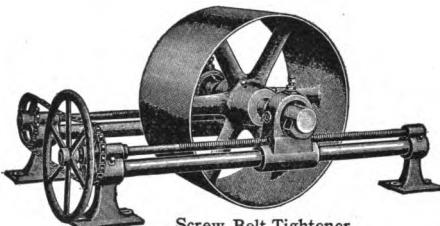
Wrenches



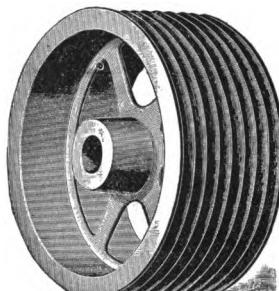
Bevel Mortise Gearing



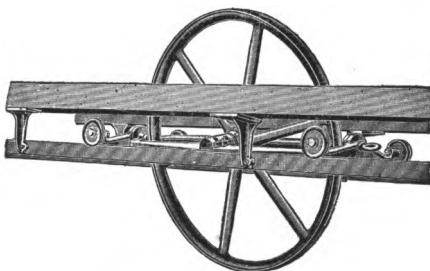
Mitre Gearing



Screw Belt Tightener  
Horizontal and Upright



Finished Iron Sheaves  
For Manila Rope Transmission



Horizontal Tension Carriage  
Double Track

# ONEIDA STEEL PULLEY COMPANY

ONEIDA, NEW YORK

MANUFACTURERS OF HIGH GRADE STEEL PULLEYS

The ONEIDA has the best possible belt adhesion since the oval crown face fits the belt perfectly.

Being held to the shaft by compression the bolts may be drawn extremely tight making it practically a positive drive.

Owing to the blade like arms the ONEIDA has slight windage.

This pulley weighs but  $\frac{1}{2}$  to  $\frac{1}{3}$  as much as a cast iron pulley and thereby saves from  $\frac{1}{2}$  to  $\frac{2}{3}$  of the actual H. P. required to revolve a cast iron pulley.

The particular advantage of the Oneida is that it is made in the greatest range of sizes of any steel pulley in the world, thus making it possible to equip any mill complete with one make of pulley. They may be made to fit any standard size shaft by means of a system of interchangeable bushing.

## Range of sizes

Diameter	-	-	-	-	6" to 126"
Face	-	-	-	-	2" to 40"
Bore	-	-	-	-	$\frac{1}{4}$ " to $8\frac{1}{2}$ "

Is made in split form and is thereby easily erected on shaft and does not necessitate the removal of other pulleys and hangers to be placed in position.



This illustration shows the fishplate reinforcement of rim and style of riveting to the arms. Note how the parts are made male and female.

Impossible to bring to bear a shearing strain on the rivets that would cut them.

We also manufacture belt and conveyor pulleys, drums, elevator, head, tail and tripper pulleys, flange and special railroad pulleys.

Send for our large and complete catalogue.



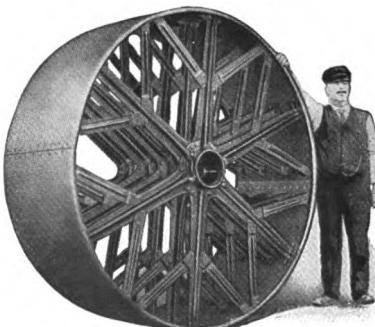
11 x 3 x 3 1/2



16 x 4 x 3 1/2



34 x 6 x 3 1/2

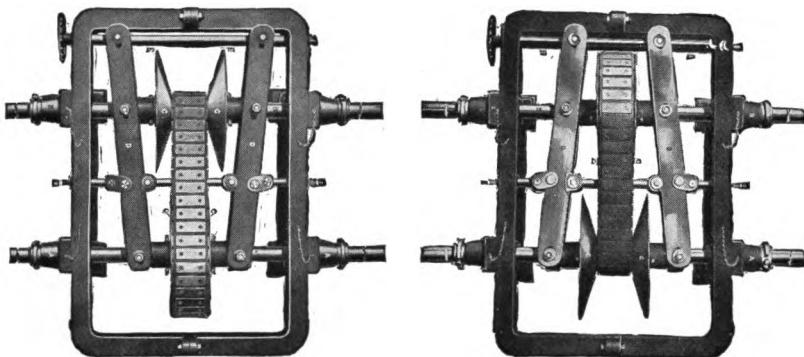


78 x 32 x 8 1/2

**REEVES PULLEY COMPANY**  
COLUMBUS, IND.

Branch House: Clinton and Monroe Sts., Chicago

**"THE REEVES" PATENT VARIABLE SPEED TRANSMISSION, PATENT  
WOOD-SPLIT PULLEYS, PATENT WOOD-SPLIT PULLEY CLUTCH,  
POWER TRANSMISSION APPLIANCES**



**"THE REEVES" VARIABLE SPEED TRANSMISSION**

**Construction and Operation.** The essential feature is that two pairs of cone disks are spline mounted on two parallel shafts. These disks are operated by a pivoted bar which is operated by a screw in such manner that one pair of disks is brought together while the other pair is forced an equal distance apart. At the same time a uniform tension of the special belt is maintained. Efficiency from 80% to 95%, according to conditions of the service.

The inner sides or faces of the disks form a V-shaped groove into which is fitted an especially designed belt, having its bearing surface on the edges instead of the bottom, as with an ordinary belt.

One set of disks acts as driver and the other driven. As the disks are actuated so the belt assumes the large diameter on one pair of disks, it at the same time assumes the small diameter on the opposite pair, thus increasing or diminishing the speed of the driven shaft, and giving any speed between the two extremes of variation.

**Installation.** "The Reeves" Variable Speed Transmission is installed in the same manner as an ordinary countershaft and may be placed on the floor or suspended from the ceiling as desired.

**Application.** It may be applied to any machine or mechanical device whatever requiring variable speed, such as Iron Working Tools, Canning Machinery, Packing Machinery, Bakers' Machinery, Laundry Machines, Textile Machinery, Veneer Cutters, Dryers, Cement Machinery, Paper Making Machinery, etc.

**Sizes.** Made in sizes from 2 H.P. to 150 H.P. Speed Variation as great as ten to one, or less as required.

Catalogue on request.

**"THE REEVES" WOOD-SPLIT PULLEY**

"The Reeves" Wood-Split Pulleys are made in all sizes up to 30 ft. diameter. Being fitted with interchangeable bushings they may be changed from one shaft to another of different size at an expense of a few cents for a new bushing.

Stocks carried in all jobbing centers.

Catalogue on request.

## *Power Transmitting Machinery*

### T. B. WOODS SONS CO.

CHAMBERSBURG, PA.

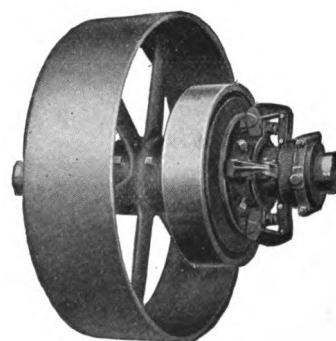
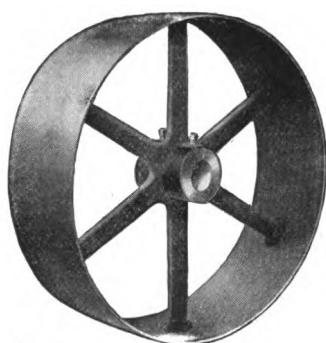
MANUFACTURING ENGINEERS,  
POWER TRANSMISSION MACHINERY

Base Plates, Plain and Adjustable.  
Belt Clamps.  
Belt Shifting Appliances.  
Belt Tighteners.  
Binder Frames, Single and Double Brace.  
Bushings, Cast-Iron for Loose Pulleys,  
Phosphor Bronze, Patent Bronze Graphite.  
Couplings, Collins Compression, Double  
Cone Vise Compression, Plate or Flange,  
Ribbed Compression, Ring Compression, Shift-  
ing Jaw Clutch, Solid Sleeve, Universal Giant  
Compression, Friction Cut-off.  
Floor Stands.  
Friction Clutches, Duplex, Split, Cut-off  
Couplings, Shifter Stands.  
Girder Clamps.  
Guide Pulleys.  
Hangers, Extra Heavy Headshaft, Head-  
shaft, Double Brace, Ring Oiling Ball and  
Socket, Peerless Four Point, Bracket-Ring  
Oiling Patented.  
Mule Pulley Stands, Stationary and Ad-  
justable.  
Pillow Blocks, Ring Oiling Ball and Socket,  
Peerless Four Point, Plain Rigid, Ring Oiling  
Rigid.  
Pulleys, Single Belt Solid, Double Belt Solid,  
Split, Clamp Hub, Tight and Loose, Flange.  
Quills.  
Quill Bearings.  
Rope Transmission.  
Set Collars, Solid and Split.  
Shafting.  
Step Bearings, Plain and Adjustable.  
Vertical Shaft Bearings.  
Wall Brackets.  
Wall Frames, Steel Top, Plain and Adjust-  
able; Cast Iron, Plain.  
Sheaves.  
Tension Carriages.  
Rope.

#### **UNIVERSAL GIANT FRICTION CLUTCH WITH EXTENDED SLEEVE**

This clutch is made with an extended sleeve of standard diameter, so that an ordinary pulley, gear, rope sheave or sprocket can be used by simply keying it on sleeve of clutch. It is only necessary that the bore be same as diameter of sleeve, just as if bored to fit a line shaft. This feature eliminates the expense and delay of making up special pulleys, as is usually required.

The Universal Giant Friction Clutch is designed so that the outer rim covers and protects the friction surfaces from dust, dirt or any foreign substance. The life of all wearing parts is thus greatly prolonged and the clutch is made especially valuable for use in cement mills, phosphate factories, elevators, or any place where dust or gritty substances are afloat in the air.



# CHAMBERS BROTHERS COMPANY

Main Office and Works

FIFTY-SECOND AND MEDIA STS., PHILADELPHIA, PA.

## BRICK MAKING MACHINERY

With capacities of from 10,000 to 100,000 daily

Briquetting Machines

Single and Double Shaft Mixers

The C. A. Wentworth Washing Machine

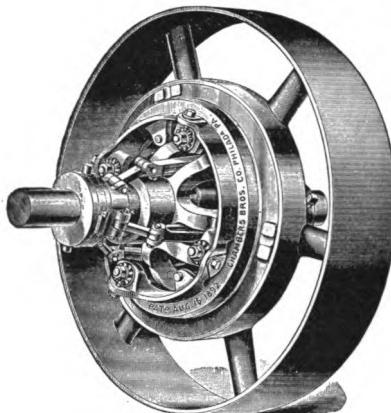
Roll Crushers

Disintegrators—Six Sizes

Pan Grinders for both Dry and Wet Grinding

7½	feet diameter	Dry Pan,	weight 25,000	lbs.
9	"	"	"	" 40,000 "
8½	"	"	Wet Pan,	" 46,000 "

Measuring and Feeding Machines, for feeding dry materials in fixed proportions.



The Flexible Friction Clutch Pulley

The Flexible Friction Clutch Pulley, a thoroughly good reliable disc clutch, unaffected by high speeds.

No. 4	Size 15	H.P. per 100 Revs. per M.
No. 5	" 22	" " " " "
No. 6	" 30	" " " " "
No. 7	" 40	" " " " "
No. 10	" 95	" " " " "

## AUBURN BALL BEARING COMPANY

22 ELIZABETH STREET, ROCHESTER, N. Y.

AUBURN BALL THRUST BEARINGS; AUBURN ANNULAR BALL BEARINGS;  
AUBURN STEEL, BRASS, AND BRONZE BALLS.



Auburn Ball Thrust Bearings are especially adapted for High Speeds and Heavy Loads in a small space due to Auburn Patented Four Point Contact Cone Principle, illustrated by the trade mark. Specially selected tool steels properly hardened through and through in the balls and races, together with careful grinding and polishing, make Auburn Bearings most durable.

Auburn Ball Thrust Bearings are used extensively for Boring, Drilling, Milling and Screw Machinery; Lathes, Elevators and Jacks; Hydraulic and all Transmission Machinery wherever the thrust of a rotating part is to be taken care of.

### AUBURN STYLE T-100 BALL THRUST BEARING.



Auburn Style T-100 bearing is a self contained ball thrust bearing. The outside retaining sleeve is attached to the lower race of the bearing with the upper race free to rotate, yet held in place. This sleeve furnishes a protection to the balls from dust and dirt, as well as making the bearing a unit. This feature greatly facilitates the assembling of the bearing on the machine and does away with the loss of balls in transit and during the operation of installing. It is a style for use in exposed places where some protection to the bearing is desired.

### AUBURN STYLE T-114 BALL THRUST BEARING.

Where there is a housing to protect the bearing this Auburn Style T-114 is desirable. It is also self-contained and a unit with the advantage of easy assembling on the machine. The retaining sleeve is attached to the bore of one race, leaving the other free to rotate, yet holding same in position. This is a style to use where a good circulation of oil must be had.



### AUBURN STYLE T-101 BALL THRUST BEARING.

When the self-contained feature is not desired Style T-101 Ball Thrust Bearing is furnished. This comprises two grooved ball races filled with balls.

Auburn Ball Thrust Bearings are carried in stock for immediate shipment covering a range of shafts up to five inches in diameter, in light and heavy types. Larger sizes with load capacities up to 200,000 pounds can be furnished promptly.

Bearings specially designed to meet unusual conditions of service can be made promptly. Write for bulletin.

# THE HESS-BRIGHT MFG. CO.

PHILADELPHIA, PA.

**HB MANUFACTURERS AND IMPORTERS OF DWF  
ANNULAR AND THRUST BALL BEARINGS**

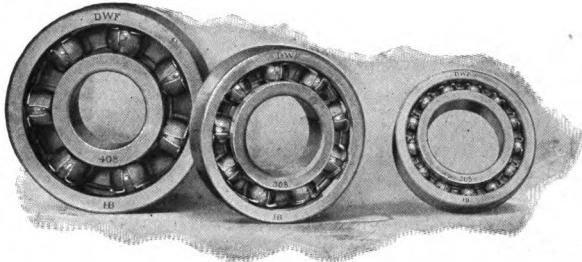
## HESS-BRIGHT (DWF) BALL BEARINGS

are used in

Lineshaft Hangers	Trolley Cars
Machine Tools	Woodworking Machinery
DYNAMOS and Electric Motors	Flour Milling Machinery
Automobiles, etc.	

Special literature on request describing these and other applications.

Aside from the economy in power which they make possible, Hess-Brights effect important savings in repair and upkeep charges, due to the fact that wear is virtually absent.



HESS-BRIGHTS of "heavy," "medium" and "light" series, for same shaft size

### ANNULAR BEARINGS

Made regularly in sizes up to 110 mm. (4.3307 inches) shaft diameter. Special sizes to order if quantity is sufficient.



Three series: "Heavy," "Medium" and "Light," for equal shaft sizes. Regular and high-speed types. Hess-Bright Annular Bearings are so constructed that the sides of the races are unbroken. This fact has an important bearing on durability.

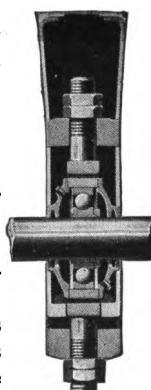
### THRUST BEARINGS

Made regularly in sizes up to 140 mm. (5.5118 inches) shaft diameter. Larger sizes on special order.

Two series: "Medium" and "Light."

One-direction and two-direction types, with or without aligning washers, though the use of such washers is recommended.

Our Engineering Department is at the service of our customers for recommendations as to type, size, and mounting of bearings to secure best results. All intending users of Hess-Brights are urged to avail themselves of this service, for which no charge is made



Section of Ceiling Hanger

## *Roller Bearing Line Shaft Boxes*

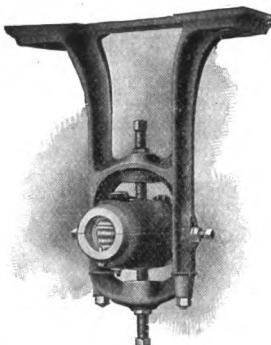
# HYATT ROLLER BEARING COMPANY

NEWARK, NEW JERSEY

### HYATT FLEXIBLE ROLLER BEARING LINE SHAFT BOXES

Actual service covering a period of over 15 years has demonstrated the Hyatt Flexible Roller Bearing pre-eminently successful for line shaft work.

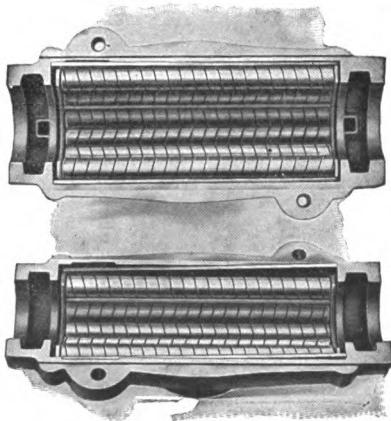
The distinctive feature of the Hyatt Flexible Roller Bearing is the roller, which is made from a strip of steel wound into a coil or spring of uniform diameter. The greatest advantage of a roller of this construction is in its flexibility, enabling it to present at all times a bearing along its entire length, resulting in a uniform distribution of load on the roller itself, as well as the surfaces on which and in which it operates. All tendency, therefore, to distortion of these surfaces is entirely eliminated, for the roller will adjust itself to all irregularities that may be present, there being no necessity for hardening the various parts of the bearing, any good steel surface satisfactorily answering all requirements.



Four-Point Set Screw

It will also be seen from its construction that the roller essentially acts as an oil reservoir, while the spiral and roller together perform the function of an oil carrier, thereby assuring perfect lubrication of all parts at all times, making it possible to operate the bearing for a considerable interval without attention.

By varying the diameter of the roller as well as the thickness, width and character of stock from which it is made, it is possible to so vary its nature as to enable it to operate under the most varied conditions, from the heaviest load on one hand to the highest speed on the other.



Halves of Split Hyatt Roller Bearing Box  
for Line Shafting

The box is of iron, cast in two parts and lined with steel. When assembled it is held by two large French-head screws, one at each end at opposite sides. At the top are automatic self-closing oil cups, eliminating foreign matter. At each end of the box are oil wells. A wiper is placed in the lower side, and as the oil works outward on the shaft it is caught by the wipers, and is returned to the bearings to be again taken up by the rollers.

Numerous tests have been made under all conditions of speed and load and in all classes of equipment, and in every instance have justified our claims of a saving in power from 10 to 25 per cent., depending upon local conditions.

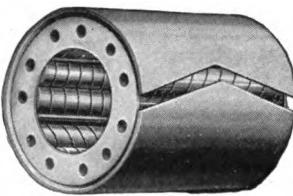
Write for Bulletin 400C.

# HYATT ROLLER BEARING COMPANY

NEWARK, NEW JERSEY

## HYATT STANDARD and HIGH DUTY BUSHINGS

The Hyatt Roller Bearing as applied to machinery in general is offered in two separate and distinct types—the Commercial Type, its original form, and the High Duty Type, a subsequent development. Both types are based upon the same fundamental principle of the Hyatt Flexible Roller, but differ so far as manufacture is concerned in the character, type and treatment of the material used, and in their commercial applications, in the conditions of speed and load involved, the limitations in sizes, the character of the apparatus in question and the particular views on the part of the designer or purchaser as to the type of bearing considered preferable.



Commercial Type

The advantages peculiar to Hyatt Bushings may be enumerated as follows:

1. The Hyatt Bearing is applicable to all speeds and loads; by employing light flexible rollers we obtain a bearing suitable for light work; by employing heavier and stiffer rollers we meet conditions involving heavy duty at slow speed.

2. The Hyatt Roller cannot crush, as it is designed to support the load with a liberal factor of safety.

3. The flexibility of the Hyatt Roller insures a full line of contact, as compared with the series of points presented by either solid rollers or balls. Consequently a uniform distribution of the load is obtained and there is no tendency to distort the metal of the journal or casings.

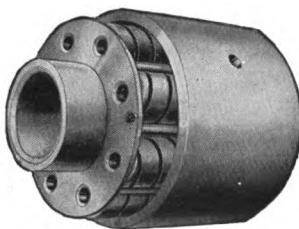
4. The Hyatt Roller acts as a natural oil reservoir, and the alternated right and left spirals act as oil carriers.

5. The Hyatt Roller has shown, under tests, a lower coefficient of friction, hence higher efficiency, than any other design.

The special bushings, heretofore furnished in small quantities, have been high priced because of the necessarily high cost of manufacturing and correspondingly high percentage of overhead expense which they had to carry.

We became convinced that adopting a number of standard sizes, manufacturing them in large quantities, and carrying them in stock, would enable us to sell these standard bushings in limited quantities at a very moderate price.

We are now in a position to furnish Hyatt bushings in any quantities at reasonable prices. They are designed for all conditions, speeds and loads, and therefore be suitable for all classes of machinery. These standard commercial bushings will be supplied in one-half inch lengths when the quantity justifies making them up. The high-duty bushings in sizes as per Bulletin 305.



High Duty Type

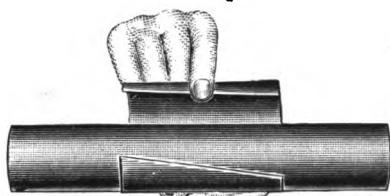
# ROYERSFORD FOUNDRY AND MACHINE CO.

52 N. 5TH ST., PHILADELPHIA, PA.

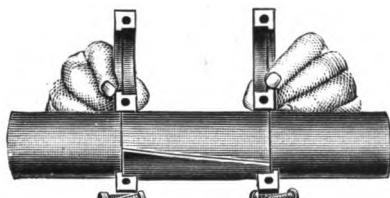
POWER TRANSMISSION MACHINERY AND SELLS ROLLER BEARINGS

## SELLS ROLLER BEARINGS — THE SPLIT BEARING

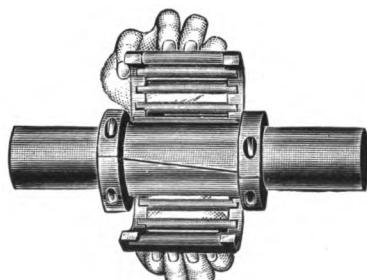
Wear of the shaft is prevented in The Sells Roller Bearings by a high-carbon steel bushing upon which the rollers operate. This bushing is split diagonally so the rollers can pass from one half to the other without breaking down the edges at the splits. Two split collars clamp the two halves of the bushing securely to the shaft. By varying the thickness of these bushings, the Sells can be adapted to fit different diameters of shafting.



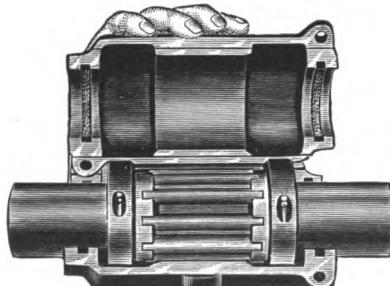
The Split Bushing



The Split Collar



The Split Roller Structure



The Split Box

## THE SPLIT COLLAR

The Split Collars not only clamp the bushing to the shaft, but also retain the roller structure between them. As these collars revolve with the roller structure, friction and wear caused by end thrust are reduced to a minimum. The shaft revolves faster than the roller structure, so that the collars assist the roller structure to revolve, and still further minimize friction.

## THE SPLIT ROLLER STRUCTURE

The roller structure is very rigid. It contains the rollers, separates them from each other, and insures alignment with the shaft.

The Rollers are case hardened steel, accurately ground to size, and being hard on the outside and soft on the inside, they are not brittle and therefore no breakage of rollers occurs.

## THE SPLIT BOX

The Split Box is made of a special gray iron casting, carefully machined. It is split with a milled tongue and grooved joint and the halves are bolted together.

Reservoirs for lubricant are provided and grease and drain holes are conveniently placed. Felt packing at the ends of the box retains the lubricant and excludes dust.

## SELLS ROLLER BEARING BOXES

Size of Shaft, Inches	Length of Box, Inches	Width of Box, Inches	Height of Box. Inches
$\frac{1}{2}$ & 1	$6\frac{1}{8}$	3	$3\frac{1}{8}$
$1\frac{1}{8}$ & $1\frac{1}{4}$	$6\frac{1}{8}$	3	$3\frac{1}{8}$
$1\frac{1}{8}$ & $1\frac{1}{2}$	$7\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{8}$
$1\frac{1}{4}$ & $1\frac{1}{4}$	8	$3\frac{1}{4}$	$4\frac{1}{8}$
$1\frac{1}{4}$ & 2	$8\frac{3}{8}$	$3\frac{1}{4}$	$4\frac{1}{8}$
$2\frac{1}{8}$ & $2\frac{1}{4}$	$9\frac{7}{8}$	$4\frac{1}{2}$	$5\frac{1}{8}$
$2\frac{1}{8}$ & $2\frac{1}{2}$	$10\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{8}$
$2\frac{1}{8}$ & $2\frac{3}{4}$	$10\frac{1}{4}$	$5\frac{1}{8}$	$6\frac{1}{8}$
$2\frac{1}{8}$ & 3	$11\frac{1}{8}$	$5\frac{1}{8}$	$6\frac{1}{8}$
$3\frac{1}{8}$ & $3\frac{1}{4}$	$11\frac{1}{8}$	$5\frac{1}{4}$	$6\frac{1}{8}$
$3\frac{1}{8}$ & $3\frac{1}{2}$	$12\frac{1}{8}$	$6\frac{1}{4}$	$6\frac{1}{8}$

For heavy duty on head and line shafts we recommend the double box described at bottom of next page.

# ROYERSFORD FOUNDRY AND MACHINE CO.

POWER TRANSMISSION MACHINERY AND SELLS ROLLER BEARINGS

**Drop Hangers.** Post Hangers and Pillow Blocks with universal adjustment are now so generally admitted to be superior to any other type, that it is needless to advance any argument in favor of their use.

Add to frames of this type a Sells Roller Bearing Box and you have practically a frictionless, non-wearing bearing.

The illustrations on this page show how Sells Roller Bearing Boxes are applied to Royersford drop hangers, post hangers and pillow blocks. They may also be substituted for old style boxes of equivalent shaft diameters, in most standard makes of hangers, post hangers, or pillow blocks.

As the boxes are split, the substitution is simple and inexpensive. Several hundred feet of line shafting can be changed over night, without interrupting the running of the plant during the day.

If Roller Bearings are an economy in all other power-transmitting work on account of their anti-frictional qualities, why will they not be just as efficient on shafting which runs steadily for ten hours a day in most plants.

If it requires power to overcome friction and steam to create power, why not use Roller Bearings and prolong the life of your equipment, as well as reduce the consumption of fuel necessary to create the power.

We guarantee a reduction in the friction load of from 40 per cent to 60 per cent, which annually will more than pay for the cost of substitution.

Further information on request.

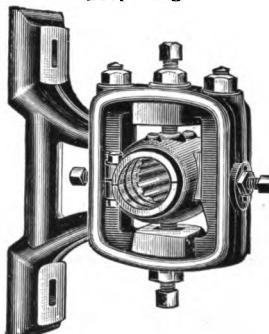
## DOUBLE BEARING FOR HEAVY DUTY

The SELLS Double Box is similar to the regular Sells Bearings, except two roller structures are used to obtain longer bearing surface, when bearing is used on head shafts or on line shafts adjacent to main driving pulley, and especially where most of load is on one bearing.

Size of Shaft, Inches	Length of box, Inches	Width of Box, Inches	Height of Box, Inches
1 $\frac{1}{2}$ & 2	13	3 $\frac{1}{2}$	4 $\frac{1}{4}$
2 $\frac{1}{2}$ & 2 $\frac{1}{4}$	13 $\frac{1}{4}$	4 $\frac{1}{2}$	5 $\frac{1}{4}$
2 $\frac{1}{2}$ & 2 $\frac{1}{2}$	14 $\frac{1}{4}$	4 $\frac{1}{4}$	5 $\frac{1}{4}$
2 $\frac{1}{2}$ & 2 $\frac{3}{4}$	15 $\frac{1}{4}$	5 $\frac{1}{4}$	6 $\frac{1}{4}$
2 $\frac{1}{2}$ & 3	15 $\frac{1}{8}$	5 $\frac{1}{2}$	6 $\frac{1}{8}$
3 $\frac{1}{2}$ & 3 $\frac{1}{4}$	17 $\frac{1}{4}$	5 $\frac{1}{4}$	6 $\frac{1}{8}$
3 $\frac{1}{2}$ & 3 $\frac{3}{4}$	17 $\frac{1}{4}$	6 $\frac{1}{8}$	6 $\frac{1}{8}$



Drop Hanger



Post Hanger



Pillow Block

## Wire Rope and Cables

# AMERICAN STEEL & WIRE CO.

CHICAGO NEW YORK WORCESTER DENVER SAN FRANCISCO

	Sales Offices:	
CHICAGO - - -	72 W. Adams St.	CLEVELAND - - - -
NEW YORK - - -	30 Church St.	DETROIT - - - -
WORCESTER - - -	94 Grove St.	ST. LOUIS - - - -
BOSTON - - -	120 Franklin St.	DENVER - - - -
PITTSBURGH - - -	Frick Bldg.	ST. PAUL-MINNEAPOLIS - -
CINCINNATI - - -	Union Trust Bldg.	SALT LAKE CITY - - - -
		Western Reserve Bldg. Foot of First St. 3d National Bank Bldg. 1st National Bank Bldg. Pioneer Bldg., St. Paul Dooley Building

## ELECTRICAL WIRE CABLES AND WIRE ROPE



LAMP CORD OF ALL KINDS AND SIZES

### SOLID CONDUCTOR AMERICORE RUBBER-COVERED BRAIDED WIRE

Fulfilling National Code Specifications, with varying thicknesses of rubber, according to required working voltage



### SOLID CONDUCTOR DUPLEX CROWN RUBBER-LEAD-ENCASED CABLE

Varying thicknesses of rubber and lead as required



### STRANDED CONDUCTOR DUPLEX CROWN RUBBER-COVERED BRAIDED CABLE

Made to National Code Specifications and also insulated for special requirements



### STRANDED CONDUCTOR VARNISHED CAMBRIC LEAD-ENCASED CABLE

For underground use. Varying thicknesses of rubber according to working voltage



### STRANDED CONDUCTOR CROWN RUBBER-COVERED TAPE AND BRAIDED CABLES

National Code thickness of rubber as well as heavier thicknesses for special voltages, both ordinary black finish and fireproof finish for station wiring and general use

We manufacture Bare Copper Wires and Cables for Telegraph, Telephone, Street Railway and Long-Distance Power Transmission purposes; also, Insulated Wire of all kinds, such as Weather-proof Wires and Cables for Arc Lighting and Street Railway Feeders, Slow-Burning Wires for Mill Construction; Magnet, Office and Annunciator Wires, Lamp Cord, Submarine Cables, Car Wires together with all kinds of Rubber Wires for the interior wiring of offices and buildings. Our American and Crown Wires are unsurpassed for this purpose. We are also manufacturers of Lead-Enclosed Cables for underground service, the same being insulated with either rubber, paper or varnished cambric, for electric lighting or power.

The cuts shown herewith illustrate a few of the many varieties of Electrical Wires and Cables made by the American Steel & Wire Company.

### UNITED STATES STEEL PRODUCTS COMPANY

Export Department

New York 30 Church St.

Pacific Coast Dept.

San Francisco - - Rialto Bldg.

Portland - - Sixth & Alder Sts.

Seattle - - -

4th Ave., South & Conn. Sts.

Los Angeles - - -

Jackson & Central Aves.

**BRODERICK & BASCOM ROPE CO.**  
 NEW YORK                    ST. LOUIS                    SEATTLE

Factories, St. Louis and Seattle

**WIRE ROPE AND AERIAL TRAMWAYS**



**YELLOW STRAND**

The strongest of all Steel Ropes

Compare the figures in the table below with those of any Plow Steel wire rope. Then you will have the real reasons for Yellow Strand's greater durability and resulting economy.

Yellow Strand's great strength permits the use of smaller rope for the same work, or heavier work with the same size rope. Its unusual flexibility gives it long life on derricks and for similar uses where the sheaves are small and the work heavy.

**YELLOW STRAND WIRE ROPE**  
 19 wires to the strand. Hemp center

TELEGRAPH NAME	Diameter in inches	Circumfer- ence in inches	Approx. weight per foot	Approx. strength tons 2000 lbs.	Prov. work load tons 2000 lbs.	Diam. drum or sheave feet ad- vised
Noggin.....	$\frac{1}{4}$	$\frac{3}{4}$	.10	3.15	.63	1
Nopal.....	$\frac{1}{8}$	1	.15	4.50	.9	$1\frac{1}{4}$
Norma.....	$\frac{3}{8}$	$1\frac{1}{8}$	.22	6.75	1.35	$1\frac{1}{2}$
Nugget.....	$\frac{7}{16}$	$1\frac{1}{4}$	.30	9.4	1.9	$1\frac{3}{4}$
Nabob.....	$\frac{1}{2}$	$1\frac{1}{2}$	.39	12.1	2.4	2
Nachar.....	$\frac{9}{16}$	$1\frac{3}{4}$	.50	14.5	2.9	$2\frac{1}{4}$
Nacon.....	$\frac{5}{8}$	2	.62	19	3.8	$2\frac{1}{2}$
Nadir.....	$\frac{3}{4}$	$2\frac{1}{4}$	.89	26.3	5.3	3
Namur.....	$\frac{7}{8}$	$2\frac{3}{4}$	1.20	35	7	$3\frac{1}{2}$
Nectar.....	1	3	1.58	45	9	4
Nelson.....	$1\frac{1}{8}$	$3\frac{1}{2}$	2	56	11	$4\frac{1}{2}$
Nero.....	$1\frac{1}{4}$	4	2.45	69	14	5
Neptune.....	$1\frac{3}{8}$	$4\frac{1}{4}$	3	84	17	$5\frac{1}{2}$
Newton.....	$1\frac{1}{2}$	$4\frac{3}{4}$	3.55	98	20	6
Nina.....	$1\frac{5}{8}$	5	4.15	110	22	$6\frac{1}{2}$
Nimrod.....	$1\frac{3}{4}$	$5\frac{1}{2}$	4.85	133	27	7
Nocent.....	$1\frac{7}{8}$	$5\frac{3}{4}$	5.55	150	30	8
Nomad.....	2	$6\frac{1}{4}$	6.30	166	33	8
Nolta.....	$2\frac{1}{4}$	$7\frac{1}{8}$	8	210	42	9
Nucleus.....	$2\frac{1}{2}$	$7\frac{7}{8}$	9.85	263	53	10
Nurse.....	$2\frac{3}{4}$	$8\frac{5}{8}$	11.95	315	63	11

Yellow Strand is also made with 7 wires to the Strand, and with wire center.

Grade for grade, our other brands of wire rope are just as superior as our Yellow Strand. Try B. & B. Plow Steel, Crucible Cast Steel, Patentsteel and Swedes Iron Elevator Ropes. They last longer.

Order direct or through any authorized agent. There is one in your locality.

Catalog No. 2D on request.

# DURABLE WIRE ROPE COMPANY

93-95 PEARL STREET,

BOSTON, MASS.

Agencies

Hegeman & Ward

43 South St., New York

Fairbanks Co.  
Baltimore

Durable Wire Rope Co.  
165 W. Lake St., Chicago

John A. Roeblings Sons Co.  
San Francisco, Portland, Seattle



This is a rope composed of wire strands, each strand being served with a specially prepared hemp marline, and the whole laid up around a manila centre. This construction makes the rope more flexible than plain wire and more durable than plain wire or manila, as it is rust and rot proof.

## GENERAL USAGES

Owing to its great flexibility and freedom from wear and rust Durable Wire Rope is especially adapted for General Hoisting, Car Hauls, Crane and Derrick Ropes, Grain Shovel Ropes, Saw Carriages, Slings.

## MARINE USAGE

Owing to its protection from rust and rot Durable Wire Rope is particularly adapted for Boat Falls, Cargo Whips, Heavy Purchases, Topping Lifts, Guy Tackles, Slings, Buoy Lines and Tow Lines, Fasts and Rigging.

## ROPE TRANSMISSION

Due to its high coefficient of friction and strength, Durable Wire "Jupiter" Transmission Rope is particularly well adapted for Rope Drives, especially the American System. A glance at the comparative table given below will demonstrate the superiority over manila ropes.

Table Showing HORSE-POWER Transmitted (per Wrap) by MANILA (M) and JUPITER (J)  
Rope, Diameter of Sheaves in Inches; Weight per Foot of Manila Rope;  
Weight per Foot of Jupiter.

Diameter of Rope in inches.	SPEED OF THE ROPE IN FEET PER MINUTE														Diameter of Sheaves in Inches	Weight per Ft. Manila Rope	Weight per Ft. Jupiter Rope				
	1,500		2,000		2,500		3,000		3,500		4,000		4,500								
	M	J	M	J	M	J	M	J	M	J	M	J	M	J							
5/8	2.3	13	3.2	18	3.6	22	4.2	25	4.6	28	5.0	31	5.3	33	5.3	35	.24	.16 .40			
3/4	3.3	24	4.3	31	5.2	38	5.8	45	6.7	52	7.2	58	7.7	62	7.7	67	.36	.20 .54			
7/8	4.5	30	5.9	40	7.0	49	8.2	58	9.1	66	9.8	74	10.8	80	10.7	86	.42	.33 .70			
1	5.8	36	7.7	48	9.2	59	10.7	70	11.9	80	12.8	90	13.6	97	13.7	105	.48	.42 .80			
1 1/8	7.5	53	9.9	69	11.7	84	13.7	100	15.4	114	16.4	128	17.4	138	17.7	148	.60	.47 1.12			
1 1/4	9.2	69	12.1	92	14.3	114	16.8	135	18.6	159	20.0	173	21.2	188	21.4	204	.72	.60 1.29			
1 1/2	11.2	80	15.0	105	17.5	130	19.9	160	22.7	182	24.4	205	25.9	230	26.1	250	.72	.70 1.66			
1 3/4	13.1	17.4	20.7	23.1	26.8	28.8	30.6	33.8	33.8	36.4	41.5	41.8	41.8	41.8	41.8	41.8	.78	.80			
2	18.0	23.7	28.2	32.8	36.4	39.2	41.5	44.8	44.8	51.2	54.4	54.8	54.8	54.8	54.8	54.8	.78	1.15			
	23.1	30.8	36.8	42.8	47.6	51.2	54.4	58.8	58.8	64.8	68.8	72.8	72.8	72.8	72.8	72.8	1.35				

JUPITER ROPE WILL RUN ON MANILA ROPE SHEAVES

# JOHN A. ROEBLING'S SONS CO.

## TRENTON, N. J.

### WIRE ROPE OF ALL KINDS

We manufacture and keep in stock at our works at Trenton and at warehouses, at agencies and branches in large cities wire rope made from Swedish Iron, Cast Steel, Extra Strong Cast Steel, Plough Steel and Improved Plough Steel.

We give below tables of strengths, etc., for the standard constructions of IMPROVED PLOUGH STEEL ROPE. The rope is also furnished with 6 strands of 37 wires each and with 8 strands of 19 wires each.

This rope is recommended as the best to use where extreme conditions tend to bring extraordinarily severe stresses, and is particularly well adapted to resist abrasion.

The hemp center of this rope is colored blue to distinguish it from other wire ropes.

A copy of our catalogue, giving information about other wire ropes, and wire rope fastenings, will be mailed on application.

#### IMPROVED PLOUGH STEEL HOISTING ROPE

Composed of 6 Strands and a Hemp Center, 19 Wires to the Strand.

Trade Number.	Diameter in inches.	Approx. circumf. in inches.	Approx. weight per foot.	Approx. strength in tons of 2000 lbs.	Proper working load in tons of 2000 lbs.	Dia. of drum or sheave in feet advised.
00	2 $\frac{3}{4}$	8 $\frac{5}{8}$	11.95	315	63	11
0	2 $\frac{1}{2}$	7 $\frac{1}{8}$	9.85	263	53	10
1	2 $\frac{1}{4}$	7 $\frac{1}{8}$	8	210	42	9
2	2	6 $\frac{1}{4}$	6.30	166	33	8
2 $\frac{1}{2}$	1 $\frac{1}{8}$	5 $\frac{5}{8}$	5.55	150	30	8
3	1 $\frac{3}{4}$	5 $\frac{1}{2}$	4.85	133	27	7
4	1 $\frac{1}{2}$	5	4.15	110	22	6 $\frac{1}{2}$
5	1 $\frac{1}{2}$	4 $\frac{1}{4}$	3.55	98	20	6
5 $\frac{1}{2}$	1 $\frac{1}{8}$	4 $\frac{1}{4}$	3	84	17	5 $\frac{1}{2}$
6	1 $\frac{1}{4}$	4	2.45	69	14	5
7	1 $\frac{1}{8}$	3 $\frac{1}{2}$	2	56	11	4 $\frac{1}{2}$
8	1	3	1.58	45	9	4
9	$\frac{7}{8}$	2 $\frac{1}{4}$	1.20	35	7	3 $\frac{1}{2}$
10	$\frac{7}{8}$	2 $\frac{1}{4}$	.89	26.3	5.3	3
10 $\frac{1}{4}$	$\frac{5}{8}$	2	.62	19	3.8	2 $\frac{1}{4}$
10 $\frac{1}{2}$	$\frac{1}{2}$	1 $\frac{1}{4}$	.50	14.5	2.9	2 $\frac{1}{4}$
10 $\frac{3}{4}$	$\frac{1}{2}$	1 $\frac{1}{4}$	.39	12.1	2.4	2
10a	$\frac{1}{2}$	1 $\frac{1}{4}$	.30	9.4	1.9	1 $\frac{1}{4}$
10b	$\frac{5}{8}$	1 $\frac{1}{8}$	.22	6.75	1.35	1 $\frac{1}{2}$
10c	$\frac{1}{2}$	1	.15	4.50	.9	1 $\frac{1}{4}$
10d	$\frac{5}{8}$	1 $\frac{1}{8}$	.10	3.15	.63	1

#### IMPROVED PLOUGH STEEL ROPE

For Haulages and Transmissions. 6 Strands and a Hemp Center, 7 Wires to the Strand.

11	1 $\frac{1}{2}$	4 $\frac{3}{4}$	3.55	90	18	11
12	1 $\frac{3}{8}$	4 $\frac{1}{4}$	3	79	16	10
13	1 $\frac{1}{4}$	4	2.45	67	13	9
14	1 $\frac{1}{8}$	3 $\frac{1}{4}$	2	52	10	8
15	1	3	1.58	42	8.4	7
16	$\frac{7}{8}$	2 $\frac{3}{4}$	1.20	33	6.6	6
17	$\frac{7}{8}$	2 $\frac{3}{4}$	.89	25	5	5
18	$\frac{11}{16}$	2 $\frac{1}{8}$	.75	20	4	4 $\frac{1}{4}$
19	$\frac{7}{8}$	2	.62	17 $\frac{1}{4}$	3.5	4 $\frac{1}{2}$
20	$\frac{11}{16}$	1 $\frac{1}{4}$	.50	13	2.6	4
21	1 $\frac{1}{2}$	1 $\frac{1}{2}$	.39	11	2.2	3 $\frac{1}{2}$
22	$\frac{11}{16}$	1 $\frac{1}{4}$	.30	7 $\frac{1}{4}$	1.5	3
23	$\frac{5}{8}$	1 $\frac{1}{8}$	.22	6 $\frac{1}{2}$	1.3	2 $\frac{1}{4}$

## WATERBURY COMPANY

80 SOUTH STREET, NEW YORK CITY

MANILA AND SISAL ROPE; WIRE ROPE OF EVERY DESCRIPTION; MUSIC WIRE;  
OIL WELL LINES, BOTH WIRE AND FIBRE; RUBBER INSULATED WIRES; LEAD  
COVERED CABLES



### TRANSMISSION ROPE

Made from highest grade of Selected Cebu Manila Hemp.  
This Rope is especially adapted to power driving, hoisting and other purposes where conditions require a superior Rope.

### GORE CONSTRUCTION WIRE ROPE (Patented)

Made 6 strands, 19 to 61 wires to strand, according to size.  
Furnished in Crucible Cast Steel, Extra Strong Cast or Plow Steel stock. The strands in this class of Rope are wound with flat wires having convex edges, which wires take the abrasion on crown of strands. The initial factor of safety is maintained longer in Gore Construction Patent than in any other class of Rope. For severe usage in Hoisting and Haulage equipments, Dredging and Steam Shovel service.

### FIBRECLAD WIRE ROPE

A combination Rope of Wire and the best grade of Tarred Russian Hemp Marline—used extensively by the United States Government, Shipbuilding Plants, Power Plants, Towing and Transportation Companies, Stevedores, Coal Companies, and in fact for all Hoisting purposes and other general uses.

### NON-ROTATING ROPE

Manufactured in various grades of steel to meet working conditions. Non-Spinning or Non-Rotating Ropes are particularly adapted to work where single lines are used, and overcome the tendency of Ropes to spin, twist, or kink, with or without load.

### ELECTRIC WIRES AND CABLES

Any Insulation—For Any Service

Rubber—Code-Intermediate—30% Para

Braided or Lead Encased.

Varnished Cambric—Weatherproof Braided, Flameproof Braided Station Cable, Lead Encased Underground Cable.

Paper—Lead Encased. Dry or Saturated Core.

Submarine Cables for any Service—

We design and install complete Aerial and Underground Systems.

# BOSTON BELTING COMPANY

256 DEVONSHIRE ST., BOSTON

100 Reade St.  
New York

90 Pearl St.  
Buffalo

169 W. Lake St.  
Chicago

55 First St.  
San Francisco

105 First St.  
Portland, Oregon

**BELTING**

**HOSE**

**PACKING**



## TRANSMISSION BELTING

**Brands**—Red Frictioned, Imperial stitched, Elmwood, Boston, Niagara, Trimount, Universal.

Adapted for all conditions of service; made from qualities and weaves of duck and grades of rubber which assure maximum service and economy.

**GUTTA-BALATA BELTING**; a high-grade textile belt, adapted for power transmission, also for conveying; so constructed that belts four-ply and heavier have absolutely seamless faces, and either side can be run next the pulleys; not injuriously affected by moderate quantities of oil or grease.

**EELSKIN SOLID WOVEN COTTON BELTING** made in three weights—single, double and triple; a solid, multiple-woven belt, woven under high tension, from high-grade yarns; thoroughly impregnated with a preservative compound; strong, flexible, adapted for service under practically all conditions.

## CONVEYOR BELTING

Made all widths and thicknesses, with regular rubber cover, or extra thick rubber cover on one or both sides, and reinforced edges; adapted for use on straight or troughing pulleys, for carrying coal, ores, grain, gravel, sand, and other materials.

**HOSE**, rubber, for water, steam, gas, air, suction, oil and fire protection.

**ROXBRO BRAIDED HOSE**, which is furnished in continuous lengths up to 500 feet, is especially recommended for pneumatic use.

**Cotton Hose**, rubber-lined, furnished in light and heavy single fabrics and medium and heavy jacket fabrics; for all kinds of fire protection equipment.



**Unlined linen hose**, American Underwriters; supplied in all sizes and lengths, for interior fire protection equipment. Approved by all insurance interests.

**PACKINGS**; sheet form, for flanges and joints; adapted for all conditions of service. Piston and valve rod packings, round, square and spiral; for hot and cold water and hydraulic purposes.

**GASKETS**

**VALVES**

**SPRINGS**

## RUBBER COVERED ROLLERS

New Rollers Complete.

Rollers Re-covered.

High-grade coverings, made from selected gums; adapted for paper and textile mill uses, tanneries, tobacco factories, and every purpose for which rubber-covered rollers are used.

# THE B. F. GOODRICH COMPANY

AKRON, OHIO

Offices in all principal cities

MANUFACTURERS OF MECHANICAL RUBBER GOODS, TIRES, ETC.

## BELTING

**TRANSMISSION BELTS**—Main drivers require the best quality. Weight and weave of duck, amount of stretch in service, and character of cover should be considered. We recommend the following grades:

“PINNACLE”—frictioned-surface, maximum strength, extreme quality.

“TITANIC”—regular covered, extra strong and long lasting for hard service.

“PILGRIM”—regular covered, heavy duck, good friction and cover; for general service.

On small pulleys operating on high speed, we recommend:

“MARATHON”—a friction surface belt of highest quality, built on special woven light, flexible duck.

Light drives, such as agricultural service, are well met by “ROB ROY,” built on medium duck, and “SIGNAL,” built on light weight duck.

**CONVEYOR BELTS** for conveying ore, coal, rock, etc., call for special qualities in the belt that have taken years of practical experience to develop. A duck of maximum strength and extreme flexibility, a strong friction, a wear-resisting cover, which will remain pliable and an edge armored against chafing are all required. We offer the following grades:

“LONGLIFE”—for severe service, where extreme wear is desired.

“MAXECON”—for ordinary service; low priced, but reliable and serviceable.

For handling grain, packages, etc., there is so little abrasion and the conditions are so dry that belts of ordinary construction can be used. We recommend our

“GRAINBELT”—medium weight duck, cover of usual thickness.

**ELEVATOR BELTS** for mines and quarries require a duck of extra strength, quality and weight to resist the tensile strains and the action of the bucket bolts. We use a special, tightly woven duck and recommend the following belts built on it:

“AKRON” Elevator Belt—high grade, designed for the hardest service.

“STERLING”—slightly lower grade, for general conditions, stitched when handling very wet materials.

Grain Elevators—Because of the dry conditions and the light material the strains are not so severe and we recommend “PILGRIM”—with a heavy duck, and “ROB ROY”—with a medium duck.

“GOODRICH AXLE LIGHTING” belt meets the severest service known—that of the electric train lighting from the car axle.

**POLISHING BELTS**—Sometimes called Emory Belts; built on especially strong fabric with light quality, tough friction.

# THE ROSENDALE - REDDAWAY BELTING AND HOSE COMPANY

NEWARK, N. J., U. S. A.

"CAMEL HAIR" BELTING, CANVAS STITCHED BELTING, SOLID COTTON BELTING, ARABIAN "ASBESTOS BRAKE LINING"

## "CAMEL" BRAND "CAMEL HAIR" BELTING

This belt is remarkable for its great strength (almost twice that of the leather belting), long life, small slippage, minimum stretching, straight true running, and for the fact that it is less affected by dampness or acid fumes than any other kind of belting. This belting is also sold under a guarantee that it will give longer, better service than any other style of belting running under the same conditions. Made in four thicknesses as follows:

SINGLE "CAMEL" which corresponds to single leather or to 4-ply canvas and rubber.

MEDIUM "CAMEL" which corresponds to heavy single leather or to 5-ply canvas and rubber.

DOUBLE "CAMEL" which corresponds to double, and heavy double leather or to 6- to 8-ply rubber and canvas.

Extra heavy "Camel" to correspond to triple leather and all extra heavy types of belting.

## STITCHED CANVAS BELTING "SPHINX BRAND"

Thoroughly equal to the best on the market in this type of belts, and affords economy if substituted as follows:

8-ply in place of double leather or 5 and 6-ply rubber.

6-ply in place of light double leather or 5-ply rubber.

4-ply in place of single leather or 3-ply rubber.

10-ply where extraordinary strength is required.

Made in all weights.

## "BLACK-BIRD" WOVEN COTTON BELTING

### FOR TRANSMISSION AND CONVEYOR WORK

An improved woven belt manufactured under high tension from the finest quality of long-staple cotton.

Impregnated with a special composition which protects the fibre, keeps the belt pliable, and prevents it from becoming hard and dry.

Will run well in steamy or wet places and on drives exposed to the weather.

## ARABIAN "ASBESTOS BRAKE LINING"

Especially suitable for automobile brakes. Made in all widths from one to four inches. Standard thicknesses  $\frac{3}{16}$ " and  $\frac{1}{4}$ ".

## JEWELL BELTING COMPANY

Established 1848

Main Office, Belt Factory and Gem Leather Tannery

HARTFORD, CONN.

Oak Leather Tannery, Rome, Ga.

Western Branch, 167 W. Lake St., Chicago

### LEATHER BELTING AND LACING

Our Tannery is located in the heart of the best Oak Bark producing section of the country. Our hides are all selected for the sole purpose of making them into Belting leather. Our plants are equipped with the most modern up-to-date machinery and appliances; especially adapted to the production of high-grade leather and belting at a minimum cost. We make a grade of belt suitable for any class of work from the heaviest to the lightest. Our grades follow:

#### JEWELL SPECIAL PLANER BELT

Made from center cuts of specially selected heaviest oak bark tanned hides; leather specially treated for the work it has to do; perfectly balanced; has a maximum of strength and a minimum of stretch and is fully guaranteed.

#### JEWELL EXTRA BELT

Made of center cuts of heavy oak tanned belting butts from which all shoulder and flank stock has been removed; guaranteed to weigh an average of not less than 16 ounces to the square foot; especially recommended for heavy duty and slow speeds.

#### JEWELL HARTFORD BELT

Made of the same kind and quality of leather as the Jewell Extra, like it in all respects except thickness or weight; guaranteed to weigh an average of not less than 14 ounces to the square foot; especially recommended for small pulleys and high speeds.

#### JEWELL DYNAMO BELT

Always made in doubles from specially selected pliable oak tanned leather; perfectly balanced and constructed with special reference to the work it would have to do on electrical and other machinery having small pulleys running at high speeds.

All the above grades are fully guaranteed as to every detail of material and workmanship. All are put together with waterproof cement and oil dressed at special prices upon special request.

#### JEWELL DIVER BELT

Made of the very best selected heavy oak tanned leather, put together with waterproof cement and heavily oil dressed; specially recommended for heavy duty and where there is more or less dampness and steam.

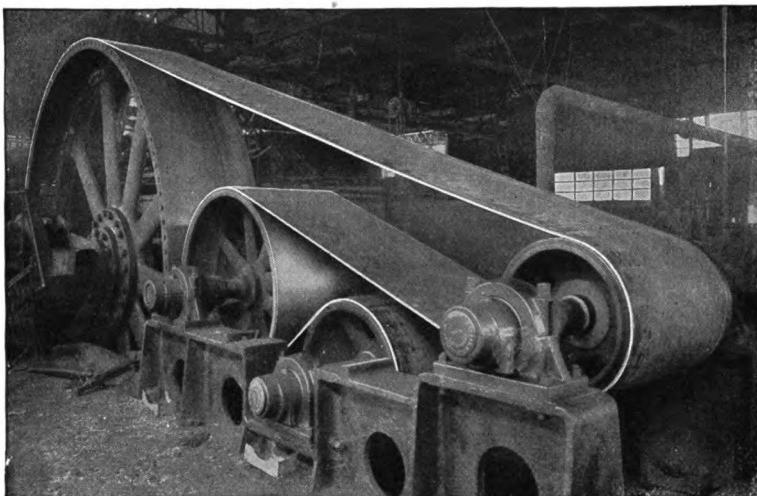
#### JEWELL ROUND BELTING

We are the largest manufacturers of Round Belting in the world. It is used on sewing machines and all other machinery where a grooved pulley is required; for bell and register cord in street cars. Our production is over ten million feet annually. It is made in all sizes from  $\frac{1}{8}$  inch to  $\frac{17}{16}$  inch.

## JEWELL BELTING COMPANY

### JEWELL GEM LEATHER

Undoubtedly the most remarkable leather product of the Twentieth Century; tanned by a special process which produces a leather that isn't injured by the action of hot or cold water, steam, oil, gas and many acids.



48-in. 3-ply Gem Belt transmitting up to 1900 horse power, at plant of Atlanta Steel Co., Atlanta, Ga. This Belt has already lasted more than 50 per cent. longer than the best oak tanned belt ever used on this drive before.

### JEWELL GEM BELT

The Gem leather put together with a waterproof cement making a belt that is not affected by steam, gas, water, etc., as above stated, and in addition a belt that has the greatest possible pliability combined with the greatest tensile strength and the least tendency to stretch. It will slip less on the pulleys, transmit more power per inch of width with less loss of power than any belt known. The illustration herewith is a fair sample of what it will do.

### GEM BELT LACING

Made both in sides and cut lace; the strongest and most economical Belt Lacing known.

### OTHER JEWELL PRODUCTS

Other Jewell products are Agricultural Belting, Binder Straps, Trunk Straps, Skate Straps, Fan Belts, Automobile Leathers such as Brake Bands, Clutch Facings, Straps, etc., Polishing Leathers, and

### POTTER'S PATENT BELT HOOKS

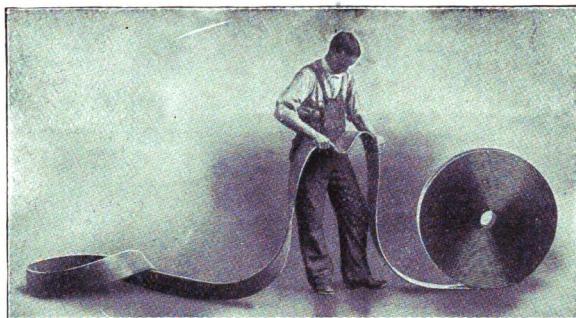
# I. B. WILLIAMS & SONS DOVER, N. H.

NEW YORK  
72 Murray St.

CHICAGO  
14-16 N. Franklin St.

BOSTON  
157 Summer St.

## LEATHER BELTING



Buying leather belting is not merely a matter of specifications, in many cases quoted but not followed. The performance of a brand of belting during past years, its general reputation among belt users—that is what tells the story.

Make searching inquiries among the large belt users and jobbers of belting as to the merits of different makes of belting, and then compare results.

You will find that

### COCHECO BELTING

stands in a class by itself as a belt that has been on the market for 70 years and has been uniformly of the highest quality.

There is only one quality put out under this brand, and there has never yet been the time when the quality has been cut to meet competition. Buyers know that to-day, next month or next year, if they specify Cocheco Belt they will get the same quality, the best center stock, heavy belt that can be produced from oak-tanned leather—at any price. In the modern factory where "efficiency" is the first consideration this reliability and uniformity mean something—are worth something.

Cocheco is made in several weights for different drives—as may be needed.

The line also includes the following—

### SHEDITE WATERPROOF BELTING

The same belt as the regular heavy Cocheco but made up by special process which makes it waterproof and steamproof. Guaranteed the equal of any waterproof belt made.

### DEFIANCE BELTING

A second cut belt. Good, heavy belting which will give good service on almost any drive. Not made over 8 inches.

### BUCKEYE SINGLE AND SPECIAL DOUBLE

Cut from lower edge stock. Heavy and of good quality and very best workmanship. A very fine low-priced belt. Not made over 5 inches.

### CAIRO SINGLE AND DOUBLE

A shoulder belt, made up carefully and sold at a very low price. A good belt for light, easy drives.

Round belting, both oak and surface tanned, in all sizes. Lace leather, both rawhide and surface tanned.

# THE DUFF MANUFACTURING CO.

N. S. PITTSBURG, PA., U. S. A.

GENUINE BARRETT JACKS; DUFF BALL-BEARING SCREW JACKS; DUFF-BETHLEHEM FORGED STEEL HYDRAULIC JACKS; GEARED RATCHET LEVER JACKS; AUTOMOBILE JACKS; TELESCOPE SCREW JACKS; OIL WELL JACKS; PIPE FORCING JACKS; MOTOR ARMATURE LIFTS, ETC.

## BARRETT TRACK AND AUTOMATIC LOWERING JACKS.

are made both single and double acting, in every type and size—for every purpose, ranging in capacity from  $\frac{3}{4}$  to 20 tons.

They are quick acting, positive and durable, and will operate on continuous work at low maintenance cost.

They comprise the most popular line of lifting jacks in the world and are recognized as the standard by all leading railroads.



## DUFF BALL-BEARING GEARED SCREW JACKS.

Are constructed of refined malleable iron and steel. All gears are of high carbon steel, drop forged, and have machine-cut teeth.

The load is carried on a large ball bearing of special design, reducing friction to an absolute minimum.

The thrust on the bevel pinion is taken by another anti-friction bearing, an exclusive feature. Made in all sizes and capacities ranging from 10 tons to 75 tons.



Sectional View

## THE DUFF-BETHLEHEM FORGED STEEL HYDRAULIC JACKS

Forged entirely out of steel—the latest and highest development in Hydraulic Jacks, they are more powerful, yet from 30 to 60% lighter than any other Hydraulic Jacks.

The design embodies no joints, few packings and but a third the number of parts of other jacks of similar type.

These jacks cause no trouble, are used at any angle, and operate at low cost under continuous service.



Sectional View

Made in 101 sizes and capacities, ranging from 10 to 500 tons.

## COMPLETE INFORMATION.

Concerning the above and other types of lifting jacks may be secured by addressing this company.

# THE RAIL JOINT COMPANY

GENERAL OFFICES:

185 MADISON AVENUE,

NEW YORK CITY

Catalog at Agencies

Boston, Mass.      Pittsburg, Pa.  
Chicago, Ill.      Portland, Oregon  
Denver, Colo.      St. Louis, Mo.

Troy, N. Y.

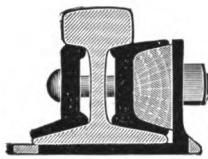
London, E. C., Eng.      Montreal, Can.

MAKERS OF BASE-SUPPORTED RAIL JOINTS FOR STANDARD AND SPECIAL RAIL SECTIONS, ALSO GIRDER, STEP OR COMPROMISE, FROG AND SWITCH, AND INSULATED RAIL JOINTS, PROTECTED BY PATENTS.

Highest Awards—Paris, 1900; Buffalo, 1901; St. Louis, 1904.



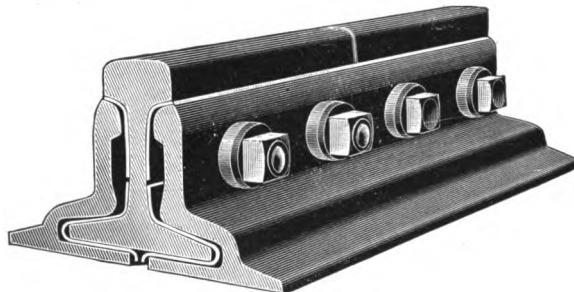
Continuous Joint



Weber Joint

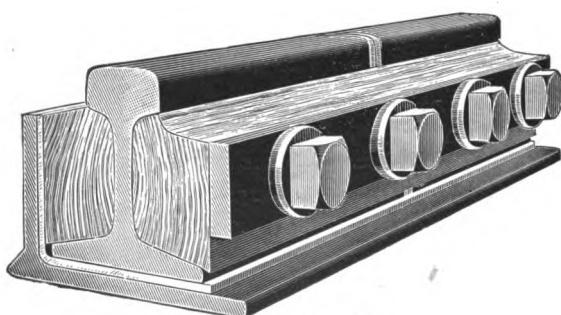


Wolhaupter Joint



Continuous Insulated Joint

Over  
50,000  
miles  
in use



Rolled  
from  
Best Quality  
Steel

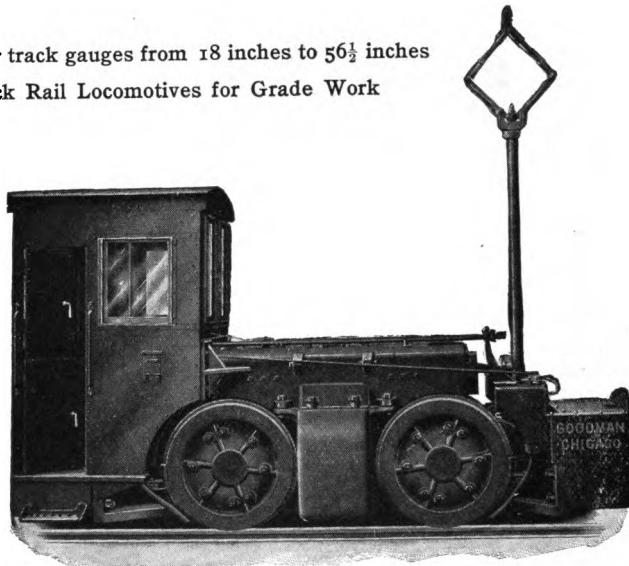
Weber Insulated Joint

**GOODMAN MANUFACTURING CO.**  
CHICAGO, ILL.

**ELECTRIC AND GAS LOCOMOTIVES FOR MINE AND  
INDUSTRIAL HAULAGE**

Built for track gauges from 18 inches to  $56\frac{1}{2}$  inches

Rack Rail Locomotives for Grade Work



**Electric Locomotives**—Single-Motor and Two-Motor in a great variety of types.

**Gas Driven Locomotives**—Using gasoline, alcohol or distillate.

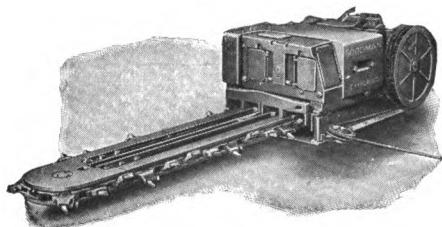
For detailed information, secure our bulletins:

No. 302—Single-Motor Locomotives No. 351—Two-Motor Locomotives

No. 303—Industrial Locomotives No. 502—Small types for switching, etc.

The **Goodman Handbook** also is of value as a compendium of information regarding locomotive practice and the Goodman Line. It will be sent free to persons interested in locomotives or coal cutting machinery.

We make a full line of  
**Coal and Clay Cutting Machinery**



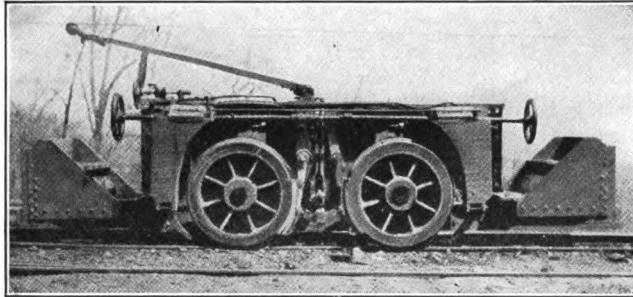
Breast Machines  
Shortwall Machines  
Longwall Machines

Ask for Bulletins  
Nos. 101 and 103

# MORGAN - GARDNER ELECTRIC CO.

CHICAGO, ILLINOIS

ELECTRIC MINE LOCOMOTIVES; ELECTRIC COAL CUTTING MACHINES; ELECTRIC DRILLS.



Mine Locomotive; 5 tons to 25 tons weight; 250 and 500 volts, 50 to 250 Horsepower.

We build all standard sizes, from 50 to 250 H.P., and weights from 5 to 25 tons. They are double armature type with four (4) driving wheels and flexible base. This flexibility makes it possible for the wheels to follow the rails on very narrow or uneven tracks.

The main frame is made all in one piece and closed across the bottom, which prevents the dirt and mud from getting up into the working parts. The frame also comes all inside between the drive wheels, which allows it to run in entries with small space outside of the rails, where an outside framed Locomotive could not be used.

The frame at each end is higher than at the sides, so as to protect the motorman in case of an accident. The Motors are of the multipolar type with internal fields, and completely closed in, except small opening at Commutator, which is protected by a cover, thus avoiding any danger of slate, or any substance from falling into the Armatures.

All gears are made from cast or hammered steel, and can be removed without taking the Locomotive apart. The Locomotive is provided with controlling lever, reverse lever, sand box levers, brake levers and electric headlight on both ends. The brakes will hold the wheels dead on sanded track.

The Drive Wheels have iron centers with rolled steel tires.

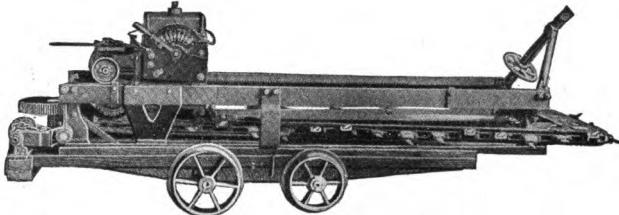
The controller is of best magnetic blowout construction, thoroughly insulated throughout, entirely waterproof, and guaranteed under full current to show rise not over fifty degrees above normal temperature. Large number now in use. Send for testimonials and prices. Special sizes and designs furnished. Full guarantee with each Motor.

## TYPES AND RATING DATA MORGAN-GARDNER STANDARD MINE LOCOMOTIVES.

Type	Weight	Gauge		Wheel Base	Height to Top of Motor Inches	Height over All Roads, Etc. Inches	Length of Motor Inches	Length with Bumpers Inches	Diam. of Drivers Inches	Draw Bar Pull	Speed in M. P. H.	Approximate K. W.	No. of Inches to be added to G. for Total Width
		Max. Inches	Min. Inches										
R S	5	60	24	39 $\frac{1}{2}$	36 $\frac{1}{2}$	43 $\frac{1}{2}$	108	124	26	2500	7	37	7
R	6	60	32	39 $\frac{1}{2}$	36 $\frac{1}{2}$	43 $\frac{1}{2}$	141 $\frac{1}{4}$	157 $\frac{1}{4}$	26	3000	7	38	8 $\frac{1}{2}$
F	7 $\frac{1}{2}$	60	34	42 $\frac{1}{2}$	37 $\frac{1}{2}$	44 $\frac{3}{8}$	148	164	28	3750	7	55	8 $\frac{1}{2}$
F	8	60	34	42 $\frac{1}{2}$	37 $\frac{1}{2}$	44 $\frac{3}{8}$	148	164	28	4000	7	56	8 $\frac{1}{2}$
M	10	60	36	48	42 $\frac{3}{8}$	49 $\frac{3}{8}$	158	174	30	5000	8	74	9
M	12	60	36	48	42 $\frac{3}{8}$	49 $\frac{3}{8}$	158	174	30	6000	8	76	9
N	15	60	36	48	42 $\frac{7}{8}$	49 $\frac{7}{8}$	170	186	31	7500	8	111	9
N	17	60	36	48	42 $\frac{7}{8}$	49 $\frac{7}{8}$	170	186	31	8500	8	115	9

## MORGAN-GARDNER ELECTRIC CO.

### COAL CUTTING MACHINES.



Side view H. H. D. Machine. Undercut 5, 6 and 7 Feet.

Equipped with "Keystone" Chain and Self-propelling Truck. Wheels differentiated 2 inches in diameter to facilitate loading and unloading.

This machine weighs 2900 lbs., and is speeded to run in the full depth in  $4\frac{1}{2}$  minutes and back in 45 seconds. This speed can be increased to  $3\frac{1}{2}$  minutes, and 30 seconds backing out, according to quality of coal.

Total length of the six-foot cutting machine over all is ten feet. Height is 29 inches over all. Width across the machine at cutter head is 42 inches over the chain, and 45 inches over the bits, thus giving full 42-inch cut and allowing lap into previous cuts. The width across the frame is 24 inches; this enables the machine to be loaded on truck that will run on 28-inch gauge of track without making special truck—and still less gauge by making special truck.

The motor is of the Multipolar type with internal poles; this type of motor is very compact and accessible.

The armature is of the toothed grammé ring type, with the coils wound in slots below the surface of the armature, thus protecting them from danger by rough usage. The field coils are wound on spools that slip over the pole pieces and can readily be removed.

The gears are all made from steel with teeth cut out of the solid. The fact that our armatures run vertically does away with the bevel gears and greatly simplifies the gearing; all gears are of the plain spur type, and only one worm wheel.

We use the least number of gears or shafts in this machine that are known to be in any chain machine made at the present time. The chain is of the up-down-and-center link style, with all the bits straight and of the same length, which saves time in dressing and replacing.

Our machines are so constructed that both machine runner and helper can work at putting in bits at the same time. There are 48 bits in chain of six-foot undercut. The materials used in construction are cast and wrought steel throughout.

We use the least amperes of current per width of cut of any machine built. We use automatic throwout, both in front and back; this enables the machine to make full length cuts without danger of breaking anything. Our break washer, or safety washer, adds great security against accidental breaking.

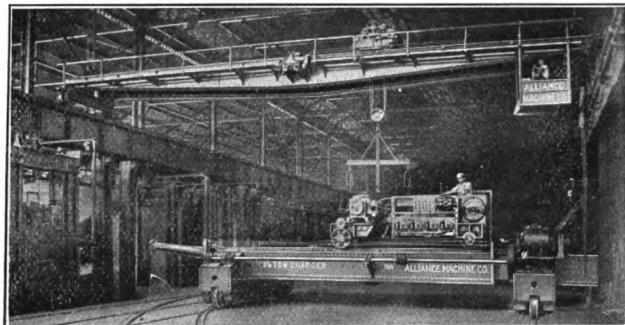
Speed of travel of chain is 273 feet per minute. Revolutions of armature per minute is 750. The Horse Power necessary to operate this machine varies from 10 to 30, according to the character of the coal or substance to be cut. Our holding device is a model of perfection. These machines are offered strictly upon their merits, and we invite the most careful and critical examinations and tests. We build them for 250 or 500 volts. Plain or self-propelling, wood or steel trucks.



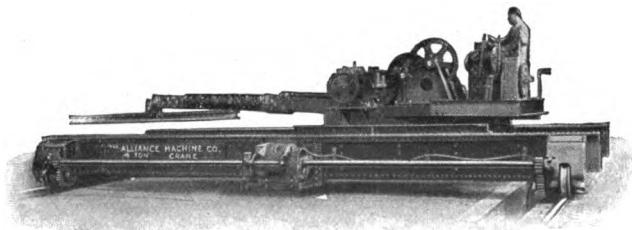
"Keystone" Chain showing Steel "Pick" Point Bits.

**THE ALLIANCE MACHINE CO.**  
**ENGINEERS AND BUILDERS**  
**ALLIANCE                    OHIO**

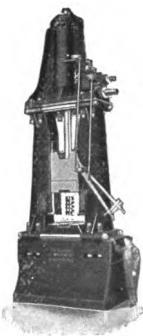
**STANDARD ELECTRIC CRANES, ELECTRIC STRIPPING CRANES, ELECTRIC SOAKING PIT CRANES, ELECTRIC LADLE CRANES, ELECTRIC BUCKET CRANES, ELECTRIC CHARGING MACHINES, I-BEAM HOISTS, ORE BRIDGES, ROLLING MILL AND HYDRAULIC MACHINERY, SCALE CARS AND CHARGING LARRIES, COPPER CONVERTING MACHINERY, STEAM HAMMERS, HEAVY PUNCHES AND SHEARS, COKE PLANT MACHINERY.**



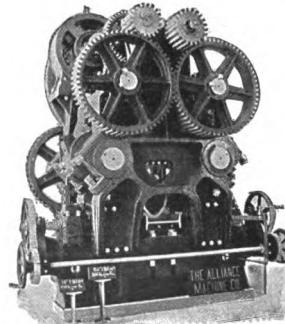
## **Open Hearth Charging Machine and Standard Overhead Traveling Crane**



### **Billet Charging Machine. Floor Type**

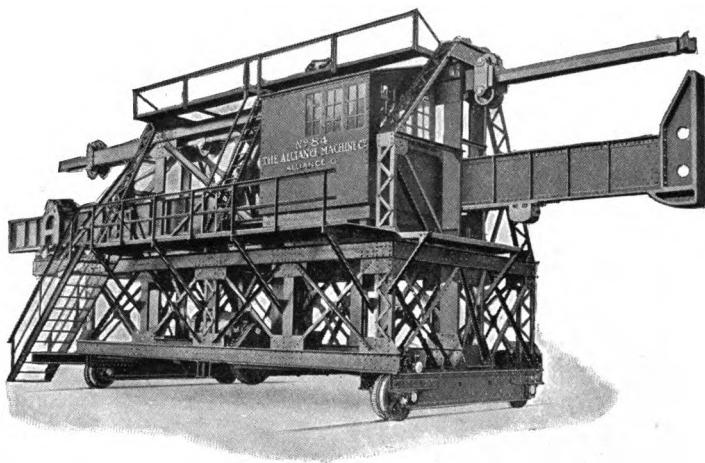


### **12000 lb. Steam Drop Hammer**



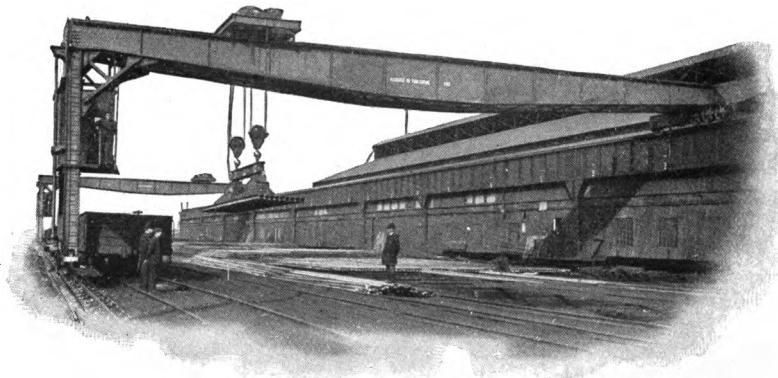
**24" Electric I-Beam Shear**

## THE ALLIANCE MACHINE CO.



### ELECTRIC COKE PUSHER AND LEVELER

The above cut illustrates the latest type of combined coke pusher and leveler. All our pushers are of the all steel construction as this is absolutely necessary for the hard service to which coke pushers are subjected. We build various types of pushers to suit all kinds of ovens. We also build hoists, larries, cars and other machinery required in By-Product Coke Plants.



### MAGNET GANTRY CRANE FOR HANDLING RAILS

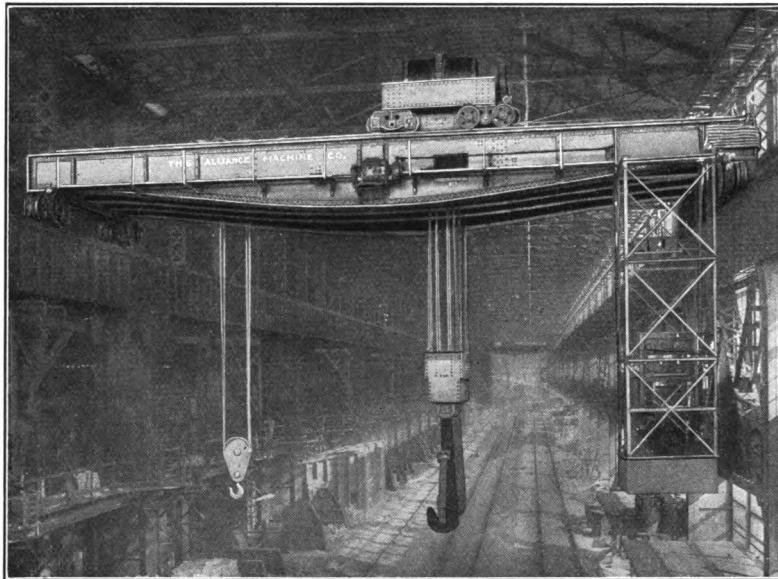
The above cut shows a single leg gantry crane equipped with special magnet for loading and unloading rails. The first day the above cranes were put in service at the plant of the Maryland Steel Company one of them unloaded a car of light rails in five minutes.

A traveling crane equipped with a magnet is absolutely the most economical way to handle material in bulk in stock yards or loading or unloading. The crane may be either standard traveling crane, single or double leg gantry or cantilever gantry, depending upon the conditions existing, and we will be glad to recommend the most suitable type.

Continued on next page

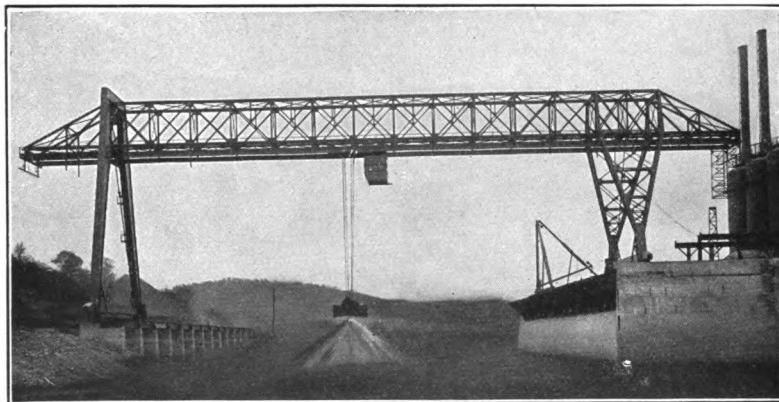
## THE ALLIANCE MACHINE CO.

Continued from preceding page



**150-TON SEVEN MOTOR FOUR GIRDER LADLE CRANE**

These ladle cranes embody distinctly new features, being provided with four separate girders secured to steel end carriages, the outer pair of girders carries the main trolley and the inner pair of girders carries the auxiliary trolley, thus permitting both trolleys to be mounted on the center of their respective girders and also allowing the hoisting ropes to descend inside the base of support of the main trolley. The crane is fully described in our general catalog.



**SIX-TON ORE BRIDGE**

Our Ore Bridges are designed along our standard gantry crane lines and are equipped with man trolleys. Trolleys are provided with two drums driven by independent motors for handling the grab bucket. Squaring shafts across the bridge for the purpose of keeping it at all times square on the runway.

# THE BROWN HOISTING MACHINERY COMPANY

CLEVELAND, OHIO

New York: 50 Church St.

Chicago: Commercial National Bank Bldg.

Pittsburgh: Frick Bldg.

San Francisco: Monadnock Bldg.

Manufacturers of  
**BROWNHOIST EQUIPMENT**

**COAL AND ORE HANDLING MACHINERY**—Bridge tramways, fast plants, cantilever cranes, gantry cranes, furnace hoists, larries, transfer cars, bins, car tipples, and pig iron breakers. These machines are designed for the rapid handling of material and a long service. They are installed in many parts of the world.

**LOCOMOTIVE CRANES**—Eight and four-wheel and for any gauge track; speediest locomotive crane built; equipped with M. C. B. couplers, standard trucks and fittings, steam brake, all steel gears; can be fitted with either block, any kind of bucket, magnet or piledriver, all interchangeable in a short time; easily operated; fitted with steam or electric power or with an internal combustion engine.

**BUCKETS**—Grab buckets, two and single rope; drag line buckets; contractors' clam shell buckets; slag buckets, and tubs. The designs of these buckets are such they get a full load each time and are under the control of the operator at all times. The best of material is used throughout, giving strength and durability to the spades, bearings, and digging edges.

**TRAMRAIL SYSTEMS**—These systems handle all the material overhead, reaching every floor in each building and as much yard space as desired. We install the systems complete using the well-known Brownhoist trolleys, which are recognized as the standard trolleys. Operated by electric or other power.

**ELECTRIC HOISTS**—DC and AC. Designed especially for a hard service at maximum rated capacity, and for safety. The load is suspended entirely from steel parts. All gears are enclosed in a cast iron casing which contains a large supply of oil. These hoists are made in various capacities.

**FREIGHT HANDLING EQUIPMENT.** This includes several different machines designed for handling the freight at a much reduced cost over the present methods. The freight is handled overhead from car to sorting platform, warehouse, wagon or other cars. It requires just a few men, eliminates confusion and costly mistakes, and increases the terminal capacity.

**FERROINCLAVE.** A patented corrugated sheet steel used as a reinforcement for concrete. It requires no forms during erection, and is easily laid by the workmen. It is used for concrete roofs, floors, bins, walls, partitions, silos, bridges, stairs, etc.

We also make overhead travelling cranes, work-car cranes, jib cranes, pillar cranes, bridge cranes, cableways, crabs, winches, transfer tables and water-closet shields.

*Catalogs and prices furnished on request*

## BROWN PORTABLE ELEVATOR CO.

HEAD OFFICE: 10 SO. LA SALLE ST., CHICAGO, ILL.

Factories at North Chicago, Ill., and Portland Oregon.

MANUFACTURERS OF PORTABLE ELEVATORS AND PILING MACHINERY, PORTABLE SECTIONAL CONVEYORS, AND WAREHOUSE EQUIPMENT.

**"Standard"** type of Brown Portable Elevator for piling Bags, Bales, Barrels, Boxes or Bundles of any kind to any height up to 30 feet.

Carrier lowers to a point six feet above floor.

**Capacity:** One to three tons per minute.

**Power:** Electric Motor or Gasoline Engine ; 2 to 5 H.P.

**In use for piling:**

Barrels of sugar, oil, etc.

Boxes of merchandise

Bundles of all kinds

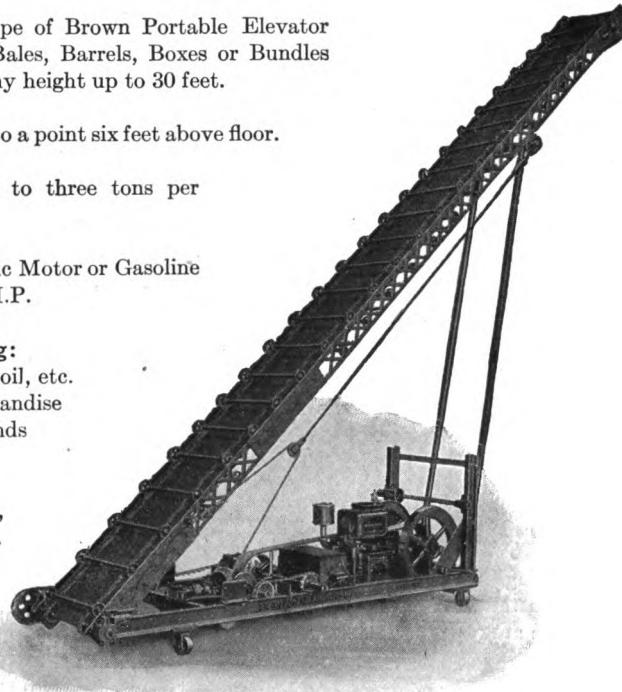
Kegs of nails

Rolls of wire

Bales of cotton,  
hay, straw, etc.

Sacks of grain,  
wool, sugar,  
fertilizer, etc.

Railway ties,  
shingles,  
etc., etc.



"Standard" Type Elevator, with Gasoline Engine

### GENERAL DESCRIPTION

The Brown Portable Elevator or Tiering Machine consists of a *frame* of wood or all-steel construction, according to the desire of the purchaser or purpose for which the machine is to be used; an adjustable *carrier* over which runs an endless

series of *carriages*, the whole mounted on easy running ball-bearing casters. All shafts turn in roller bearings.

#### Dimensions of "Standard" Type Elevators

Number	Elevates Height of	Floor Space	Approximate Weight.	
			Electric Power	Gasoline Power
0	12 ft.	82x31 ins.	900 lbs.	1400 lbs.
1	14 "	94x31 "	1000 "	1500 "
2	16 "	108x31 "	1100 "	1600 "
3	19 "	120x31 "	1400 "	1800 "
4	21 "	142x31 "	1500 "	2100 "
5	24 "	162x31 "	1800 "	2300 "
6	28 "	190x31 "	2000 "	2500 "
7	30 "	200x31 "	2100 "	2600 "

The *frame* is well built to give the machine stability and to support the weight of the carrier with its load and the motive power.

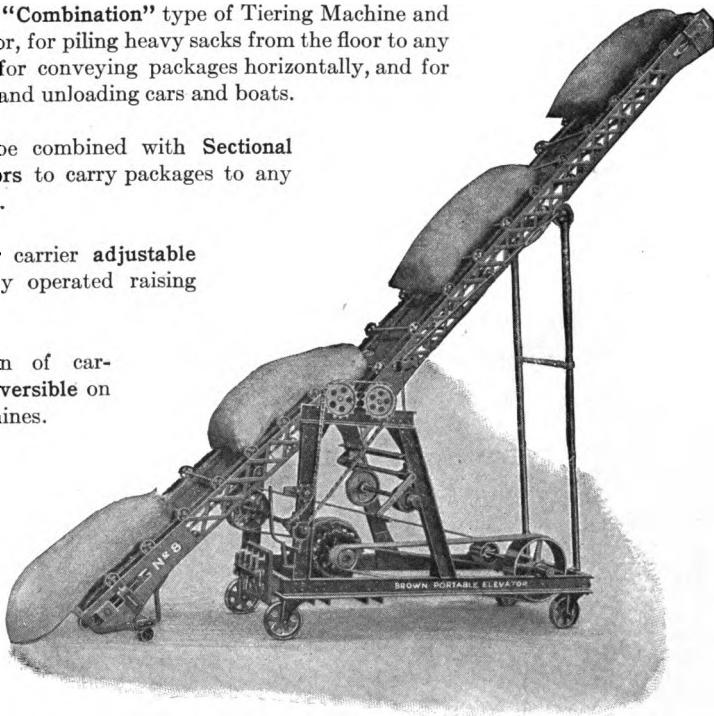
## BROWN PORTABLE ELEVATOR CO. CHICAGO, ILL.

No. 8 "Combination" type of Tiering Machine and Conveyor, for piling heavy sacks from the floor to any height; for conveying packages horizontally, and for loading and unloading cars and boats.

Can be combined with Sectional Conveyors to carry packages to any distance.

Upper carrier adjustable by easily operated raising device.

Motion of carriages reversible on all machines.



"Combination" Type Elevator, with Electric Motor

The *carrier* is pivoted to the frame at its lower end, the upper end being supported and adjusted by an upright framework of iron piping or structural steel. This is connected by a steel cable on each side of the carrier to a (hand or power) raising device mounted on the frame, by which the carrier is raised as the pile increases in height. The carrying width is made to conform with the size of packages handled. The *carriages* are designed and spaced to provide suitable support for the various sizes, shapes and widths of packages.

In operation the packages are leaned against the foot of the carrier or placed on the carriages, which carry them to the top, where they are delivered, waist-high, to men standing on top of the pile, who place them in position.

The Brown Portable Elevator represents the highest development of mechanical efficiency in the handling of packed goods. Machines are made to meet any warehouse or mill conditions, and effect a saving of 50 to 80 per cent. of the cost of piling by hand. Lower as well as elevate; no complicated mechanism; prevent tearing or breaking of packages; easily moved by two men; reasonable in cost, and built for long service.

**H. W. CALDWELL & SON COMPANY**  
CHICAGO, ILLINOIS

ELEVATING, CONVEYING AND POWER TRANSMITTING MACHINERY, MACHINE  
MOLDED AND PATTERN GEARS 1" TO 6" PITCH, CAST IRON SEMI-STEEL  
AND STEEL, LINK CHAIN BELTING, SPROCKET WHEELS, PULLEYS, FLY WHEELS,  
ROPE DRIVES, BEARINGS, COUPLINGS, FRICTION CLUTCHES, ETC.

Catalogue No. 34 contains complete lists

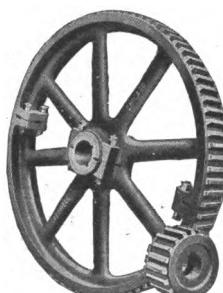
**HELICOID CONVEYOR**

Sole Manufacturers of "HELICOID CONVEYOR."  
Made of one Continuous Strip of metal without lap or rivet.  
Mounted on standard and extra heavy pipe or solid shaft.



**LIST OF SIZES WITH DIMENSIONS**  
Standard Gauge Helicoid on regular size pipe

Diameter	Standard Lengths, Feet	Diameter of Couplings, Inches	Inside Diameter of Hollow Shaft, Inches	Outside Diameter of Hollow Shaft, Inches
3		1 $\frac{1}{2}$	1	1 $\frac{1}{8}$
4	8	1 $\frac{1}{2}$	1 $\frac{1}{8}$	1 $\frac{1}{8}$
5	8	1	1 $\frac{1}{8}$	1 $\frac{1}{8}$
6	10	1 $\frac{1}{2}$	1 $\frac{1}{4}$	2 $\frac{1}{8}$
7	10	1 $\frac{1}{2}$	1 $\frac{1}{4}$	2 $\frac{1}{8}$
8	10	1 $\frac{1}{2}$	2	2 $\frac{1}{8}$
9	10	1 $\frac{1}{2}$	2	2 $\frac{1}{8}$
9 Sp'cl	10	2	2 $\frac{1}{4}$	2 $\frac{1}{8}$
10	10	1 $\frac{1}{2}$	2	2 $\frac{1}{8}$
12	12	2	2 $\frac{1}{4}$	2 $\frac{1}{8}$
12 Sp'cl	12	2 $\frac{1}{4}$	3	3 $\frac{1}{8}$
14	12	2 $\frac{1}{4}$	3	3 $\frac{1}{8}$
16	12	3	3 $\frac{1}{4}$	4



**GEARS**  
"CALDWELL-WALKER"  
SPUR BEVEL  
MITER MORTISE WHEELS  
WORMS AND WORM WHEELS  
1" TO 6" PITCH—CAST IRON—  
SEMI-STEEL—STEEL—BRONZE  
MACHINE MOLDED OR  
MACHINE CUT TEETH

## CLYDE IRON WORKS

29th AVENUE, WEST, AND MICHIGAN ST.

DULUTH, MINN.

HOISTING ENGINES, DERRICKS AND DERRICK FITTINGS, ELECTRIC HOISTS  
BELT DRIVEN HOISTS, AUTOMATIC BUCKETS

### CLYDE HOISTING ENGINES AND BOILERS

Our product is used for all kinds of Contractor's work, Dredging, Pile Driving, Railroad and Bridge Building, Quarries and general hoisting purposes. We also make a specialty of engines for skidding and loading logs, and for general logging operations.

All our engines are thoroughly tested under steam as well as by the usual hydrostatic test. All parts are made from standard jigs and templates and are absolutely interchangeable.

### ONE, TWO, THREE, AND FOUR DRUM HOISTING ENGINES

In our fifty-six page catalog we illustrate the various types of our standard engines with single or multiple drums, and single or double cylinders. These hoisting engines are regularly built with or without boiler, winch and sheave heads, and reversing gear.

### DERRICKS AND DERRICK FITTINGS

In our special Derrick Catalog D, we illustrate and list a complete line of timber derricks and fittings. All usual conditions can be met with some one of our standard styles, but we are prepared to build derricks for any special conditions that may arise. For this purpose we maintain a force of draftsmen and engineers who are specialists in this line, and their experience of many years is at the disposal of our customers.

Clyde Derricks are designed with great care to withstand violent strains. Every possible point of weakness both in the fittings and in their action on the timbers, has been guarded against and we claim our fittings to be the strongest on the market for the size of timbers for which they are intended.

Following is a partial list of our standard styles of derricks:

Standard Guy Derricks	Hand Power Stiff Leg Derricks
Half Hand Power Guy Derricks	Clam Shell Stiff Leg Derricks
Hand Power Guy Derricks	Full Circle Stiff Leg Derricks
Clam Shell Guy Derricks	Self-Propelling Derrick Cars
Standard Stiff Leg Derricks	Self-Contained Portable Derricks
Half Hand Power Stiff Leg Derricks	

We also manufacture Automatic Clam Shell, and Orange Peel Grab Buckets, and the Clyde Self Dumping Bucket. Catalogs on request.

## THE CONVEYING WEIGHER CO.

90 WEST STREET, NEW YORK, N. Y.

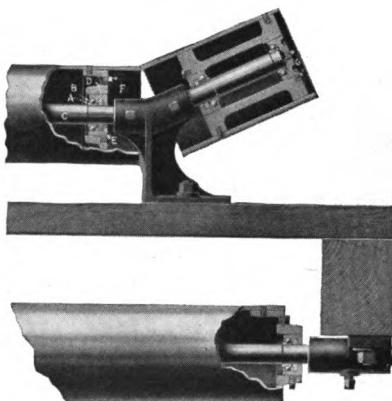
BALL BEARING BELT CONVEYORS, CONTINUOUS AUTOMATIC SCALES FOR BELT AND OTHER CONVEYORS, CONVEYING AND HOISTING MACHINERY, COMPLETE MATERIAL HANDLING PLANTS, TRUMP MEASURING AND MIXING MACHINES, TRUMP CONCRETE MIXERS, PEAT DIGGING, AND SCRAPING MACHINERY.

### BALL BEARING BELT CONVEYORS

We illustrate herewith the construction of ball bearing troughing and return idlers for belt conveyors. It is guaranteed that if a belt conveyor running level be equipped with these idlers, there will be a saving of 40% in power required. These idlers having felt oil-retaining washers need to be lubricated only once in two years.

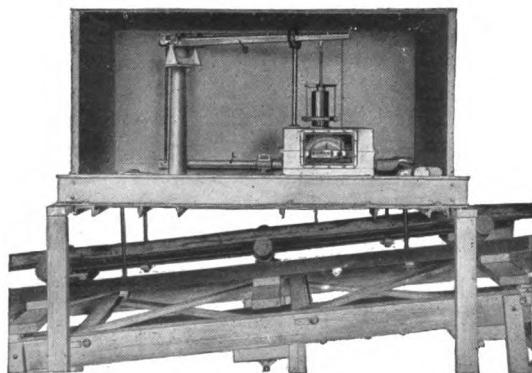
- A Hardened steel "Cone," fitted on turned steel shaft
- B Pressed steel "Ball Retainer"
- C Turned steel shaft, setscrewed in Idler brackets
- D Oiled washer of felt or carded wool
- E Hardened steel "Plug," screwed into pulley hub
- F Brass plug for lubrication
- G Lock screw to prevent hardened plug from turning

"Conweigh" Ball Bearing, troughing, and return idlers for belt conveyors (patents pending)



### THE MERRICK CONVEYING WEIGHER

This device records the weight of material handled on belt conveyors, bucket conveyors, cable railways and over head trolleys or telphers. The weigher consists of a pair of weighing levers and a steelyard of special design so that a short section of the conveyor can be suspended from the weighing levers. The extreme end of the steelyard is connected with a totalizing mechanical integrator which derives its other factor from the travel of the conveyor by means of suitable gearing from a bend pulley on the return belt, or a sprocket wheel if on a bucket conveyor. This integrator continuously totalizes the product of two quantities, one proportional to the weight of material suspended and the other to the travel of this material. The result therefore represents the total weight of material and is plainly indicated by a register.

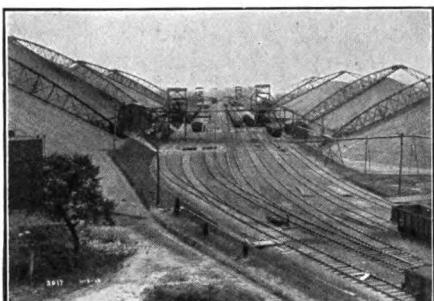


View of Belt Conveyor. Front Sheet of Casing Removed.

**THE J. M. DODGE COMPANY**  
NICETOWN STA., P. & R. RAILWAY  
PHILADELPHIA, PA.

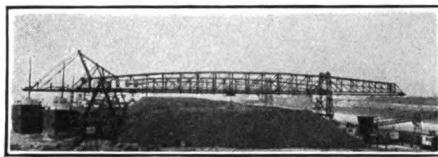
THE DODGE SYSTEM OF STORING ANTHRACITE COAL, LONG RADIUS REVOLVING CRANES, BRIDGE TRAMWAYS, DIRECT UNLOADERS, SMITH BOX CAR LOADERS, COAL CHUTES, ENDLESS CABLE HAULS FOR RAILROAD CARS, TELpherage, DESIGNERS AND BUILDERS OF LOCOMOTIVE COALING STATIONS AND RETAIL COAL POCKETS IN WOOD STEEL AND REINFORCED CONCRETE.

HANDLE COMPLETE CONTRACTS:  
FOUNDATIONS, BUILDINGS, AND MACHINERY



**THE DODGE SYSTEM**  
(Patented)  
**OF STORING**  
**ANTHRACITE COAL**

Capacity of piles from 15000 to 60000 tons. Two trimming machines and one reload machine between piles constitute one group. Its effectiveness is due to simplicity of design, mechanical efficiency, minimum breakage, and low cost of handling.



**BRIDGE TRAMWAYS AND  
DIRECT UNLOADERS**

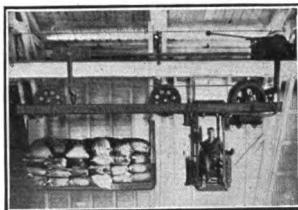
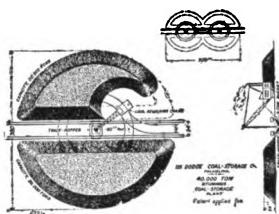
Complete installations of all types of Bridge Tramways and Direct Unloaders for high speed operation and maximum efficiency. Special attention given to the handling, storing and preparation of coal on docks.

**LONG RADIUS REVOLVING CRANES  
FOR CIRCULAR STORAGE AND  
COALING STATIONS (PATENTED)**

Suitable for storage capacities from 6000 to 40000 tons, and handling capacities from 40 to 200 tons per hour. This is the cheapest storage system for large bodies of bituminous coal or crushed stone, and combines low cost of handling with low investment cost. The crane can also be used for filling an elevated pocket for coaling locomotives, or for retail trade.

**TELpherage for Freight Handling**

Runs on top of mono-rail, permitting safest and simplest design of trolleys, combined with flexibility and smooth running at high speeds. Especially adapted for handling freight in railroad terminals and steamship piers. Special attention given to these problems.



## GIFFORD-WOOD CO.

BOSTON, MASS.

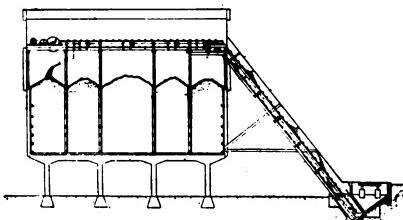
HUDSON, N. Y.

CHICAGO, ILL.

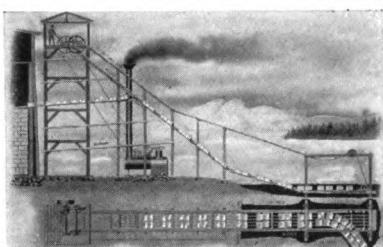
### ELEVATING AND CONVEYING MACHINERY ICE TOOLS



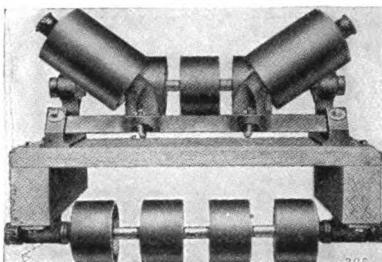
Model Coal Pocket



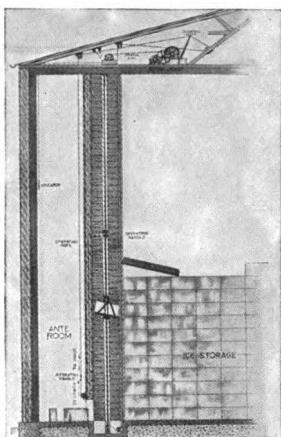
Arrangement of Machinery



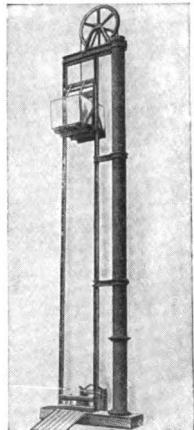
Ice Elevator



Belt Conveyors



Gig Elevator and Lowering Machine



Automatic Lowering Machine

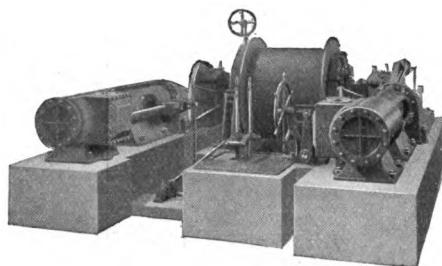
Send for Catalogs and other information desired

## HARDIE-TYNES MANUFACTURING CO. BIRMINGHAM, ALA.

HOISTING ENGINES, CORLISS ENGINES, AUTOMATIC ENGINES, SLIDE VALVE ENGINES, AIR COMPRESSORS, SPECIAL MACHINERY, HEAVY CASTINGS.

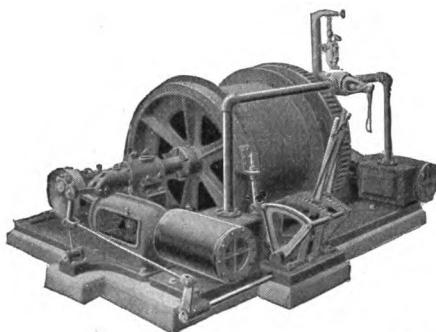
### STEAM HOISTING ENGINES First Motion Type

Built in all sizes up to and including 34x60 in. cylinders. Single or double drum. Band frictions. Link reverse. Steam auxiliaries or hand control.



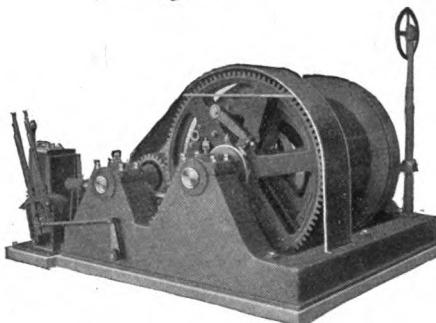
### STEAM HOISTING ENGINES Geared Type

11x14 in. cylinders to 18x24 in. cylinders. Single or double drums. Band or "V" frictions. Link reverse. These Hoists, like our First Motion Machines, are built for hard and continuous service. The smaller sizes are excellent hoists for development operations.



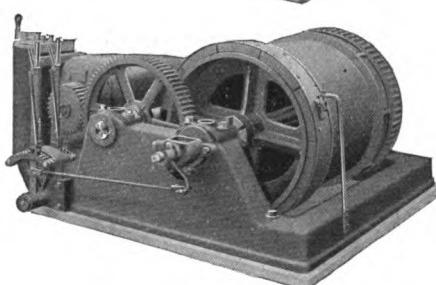
### ELECTRIC HOISTING ENGINES Band Friction Type

All sizes from 30 to 2,000 h.p. Single or double drums. Air operated auxiliaries or hand control. Built for heavy mining service.



### ELECTRIC HOISTING ENGINES "V" Friction Type

All sizes from 30 to 150 h.p. Single or double drums.

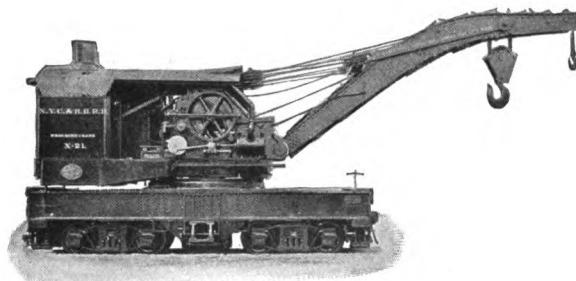


Engines for Endless Rope Haulage  
Equipment for Gravity Tramways

## INDUSTRIAL WORKS

BAY CITY, MICH.

WRECKING CRANES, LOCOMOTIVE CRANES, DRAG LINE EXCAVATORS, PILE DRIVERS, TRANSFER TABLES, PILLAR CRANES, HAND POWER DERRICKS, GRAB BUCKETS, LIFTING MAGNETS, ETC.

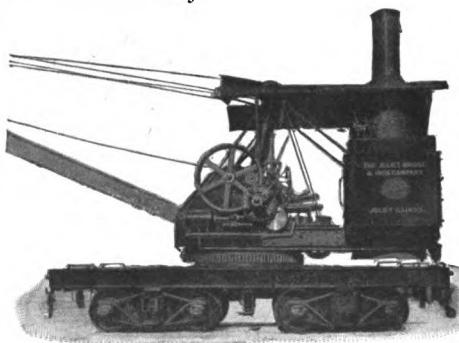


Wrecking Crane, capacity 120 tons at 17 ft. radius

Industrial Works cranes are built in all sizes from 1 to 150 tons capacity on the main hoist. Locomotive and Wrecking Cranes from 5 to 150 tons capacity may be self-propelling or non-propelling as desired. On this crane are three hoisting motions, main hoist, auxiliary hoist, and jib hoist. These are entirely independent of each other; are provided with independent brakes and operated by independent trains of cut steel gearing so that changes from one motion to the other are made with ease, and all parts are open and accessible.

In none of the three motions is any use made of ratchets for holding suspended loads, either during operation or during transfer from one motion to the other. These functions are performed by powerful brakes and self-locking worm wheels which enable the operator to use the motions with rapidity and safety.

Stability is provided by a system of telescopic out-riggers, all of which are self-contained within the car body.



Locomotive Crane for yard and road service

When desired any of our cranes may be equipped with an auxiliary drum and connections for operating a Grab Bucket; also complete equipment for operating Lifting Magnet.

Detailed specifications and full particulars furnished on application.

# ROBINS CONVEYING BELT CO.

PARK ROW BUILDING, NEW YORK

Chicago

San Francisco

Spokane

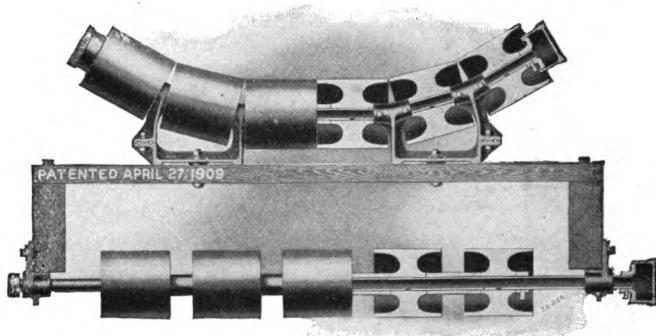
WORKS: PASSAIC, N.J.

## CONVEYING, ELEVATING, AND HOISTING MACHINERY

For Handling.

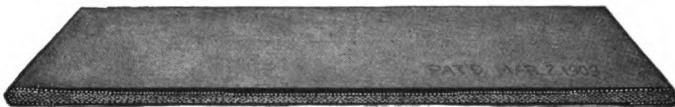
Coal	Concrete	Sand	Earth	Boxes	Trunks
Coke	Rock	Gravel	Cement	Barrels	Dishes
Ores	Phosphate	Chips	Ashes	Packages	Bags

### ROBINS STANDARD AND ADJUSTABLE COAL AND COKE CRUSHERS



The most important elements of a Belt Conveyor are the Idlers and the Belt, since on these depends its proper operation as well as the cost of handling. The Robins Patent 5-shaft Trougling Idlers, shown above, are universally accepted as the Standard, being the only ones which embody the following important principles of design:

(1) All the pulleys are in the same *vertical plane*. (2) They have continuous hollow-tube grease-lubrication from end to end. (3) The profile of the idler nearly approaches the arc of a circle, preventing sharp bends in the belt. (4) The idlers are adjustable for properly training the belt. They are made in all sizes from 12" to 60".



The Robins Patent Reinforced Conveyor Belt, shown above, has been one of the chief factors of the success of the Robins System. Sixteen years of hard trial, under all kinds of conditions, have demonstrated that it is stronger, runs truer, and gives a greater return for the money than any other belt on the market. This is due to the following peculiarities of construction:

- (1) The rubber cover is thickened in the center only, *where the wear is greatest*.
- (2) The edges are reinforced by extra plies of duck, increasing the strength and making the belt self-supporting between idler sets.
- (3) Being very flexible laterally it conforms closely to the shape of the idlers, and therefore runs true even when empty. With this belt no guide idlers are required.
- (4) An extra ply of special coarse fibre embedded in the cover and extending around the edges enormously increases the resistance of the cover, and also the adhesion between the cover and the body.

The Robins Monthly Bulletin, containing valuable conveying engineering data, is gladly sent to all interested persons.

## C. W. HUNT COMPANY

WEST NEW BRIGHTON, STATEN ISLAND, NEW YORK

New York City Office, 45 Broadway

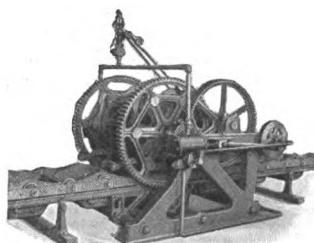
THE HUNT NOISELESS GRAVITY CONVEYOR, HOISTING AND CONVEYING MACHINERY, CABLE AND AUTOMATIC RAILWAYS, STEEPLE TOWERS, TUB ELEVATORS, SKIP HOISTS, ELECTRIC LOCOMOTIVES, MOTOR CARS, INDUSTRIAL RAILWAY EQUIPMENT, TRANSMISSION AND HOISTING ROPE.



### Distinctive Features of the HUNT NOISELESS GRAVITY CONVEYOR

The Hunt Noiseless Gravity Conveyor consists of a series of independent buckets free to swing and dump in either direction. The buckets hang upright in all positions of the chain, consequently the chain can run in any direction and dry or liquid material may be carried without spilling.

The whole machinery is carried on wheels and every part is thoroughly lubricated. Change of direction of the chain is accomplished by running around revolving curves. As shown, these have large bearings so that frictional loss and wear on the chain at these points is reduced to a negligible quantity.



The driving apparatus may be placed  
at any point along the line

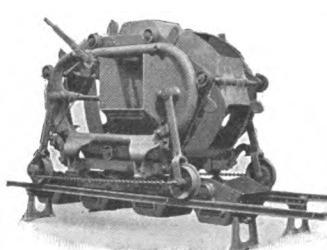
Motion is transmitted to the conveyor chain by an independent pawl driver. The contact from the driving pawl is made on a stud rivetted between the chain links. This relieves the conveyor wheels of the driving stress and transmits a uniform and even motion to the chain. The conveyor driver can be placed at any convenient point on the horizontal line of the conveyor.

Either a steam engine which we design for this purpose or an electric motor may be used for power.

Several methods of filling are practical. Our spout filler fills each bucket completely as the bucket passes underneath it, and also prevents the dropping of material between the conveyor buckets or on the chain or the wheel bearings. Our rotary or measuring filler measures out and deposits a fixed amount of material in each passing bucket. Either type of filler can be easily moved to any receiving point on the line of the conveyor.

This conveyor is thoroughly strong in every part, with large bearing surfaces and with convenient oiling arrangements. The materials and workmanship are excellent in every respect. The chain is made of open hearth steel and the axles of special machinery steel.

Write for special catalog.

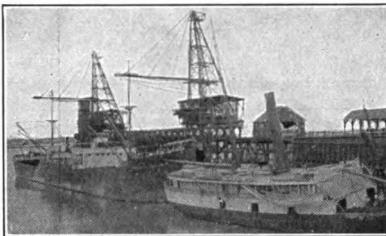


The patented filler fills every bucket  
without spilling

**C. W. HUNT COMPANY**  
WEST NEW BRIGHTON, NEW YORK

**HUNT STEEPLE TOWERS**

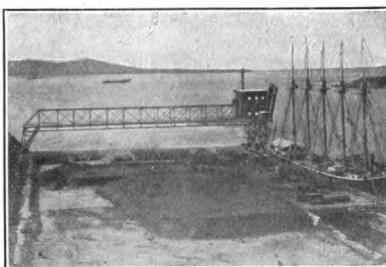
are designed to be operated by one engineer. One engine is required for hoisting the steam shovel and another for running the trolley on the booms. Great speed makes these outfits especially suited to rapid unloading of vessels. The projecting booms are usually hinged to swing horizontally over the wharf. Where obstructions such as the rigging of vessels interfere, the booms can fold up in a vertical plane. Capacity of buckets ranges from  $\frac{1}{2}$  to  $2\frac{1}{2}$  tons.



Hunt Steeple Towers

**HUNT TRANSPORTING BRIDGES**

are adapted to the storage and reclaiming of coal over large areas. The one shown has a four-drum equalizing engine and operates with grab buckets at a capacity of 120 tons per hour. Furnished in capacities up to 600 tons per hour.



Hunt Transporting Bridges

**INCLINED BOOM HOISTING ELEVATORS**

are for rapid and economical hoisting of materials from vessels. The bucket, whether large or small, is carried from the hold of the vessel to the dumping place every trip in exactly the same course, and at any rapidity demanded. The bucket is carried exactly where wanted, rising vertically from the hold to the boom, running up the boom, and dumping at a fixed place.

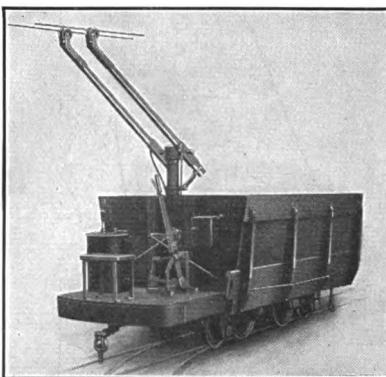


Inclined Boom Hoisting Elevators

These elevators are proportioned to suit the work and for use either with tubs or grab buckets. The lighter size is especially adapted for coal or ore hoisting, using any size bucket up to one-ton capacity.

**HUNT MOTOR CARS  
Self-Dumping**

made in many types, capacities up to 10 tons, and are equipped with motors and overhead trolleys or shoes for third rail as desired. Suitable for transporting coal, fertilizer materials, ores, and other bulk materials.



Hunt Motor Cars  
Self-Dumping

Catalogs on request.

## THE LAMSON COMPANY

BOSTON, MASS., U. S. A.

PNEUMATIC TUBES—CASH, PARCEL, MESSAGE, AND MAIL CARRIERS; AUTOMATIC, SWEEP-OFF, PICKUP AND SELECTIVE CARRIERS; BELT CONVEYORS, TRAY CONVEYORS, SMALL LIFTS, ELEVATORS, ETC.

### PNEUMATIC DESPATCH TUBES

Designed and installed for all Office, Factory, Warehouse, Postal or Store Service requirements. Vacuum, Pressure, Vacuo-Pressure, Unit, "Two-way," Shifting Current or "Steam-jet" types in sizes of tubes ranging from  $2\frac{1}{4}$  in. to 8 in. diameter. Latest Power-saving inventions. Over 50,000 stations of Lamson Tubes in use.

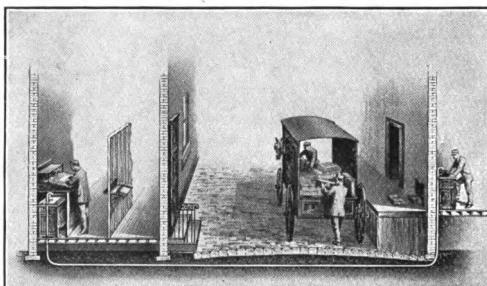


Desk Station 4" Mail Tubes in Private Office

### FOOT POWER PNEUMATIC TUBES

No power plant required, operated by foot pressure. Efficient for lines up to 200 feet in length. Speaking tube attachments at small additional cost.

Sizes  $2\frac{1}{4}$  and 3 inch O. D.

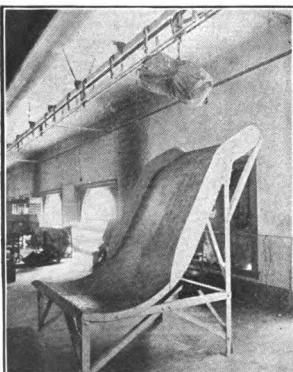


Carrying Documents Between Buildings

### SELECTIVE CARRIERS

Entirely automatic—pick up a load at any point and deliver it at any desired station.

Made in any size to meet requirements—from carrying single sheets of paper to heavy bags of mail.

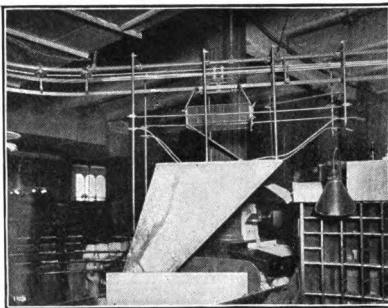


Automatic Mail Bag Carriers

## THE LAMSON COMPANY

### AUTOMATIC SWEEP-OFF AND DELIVERY CARRIERS

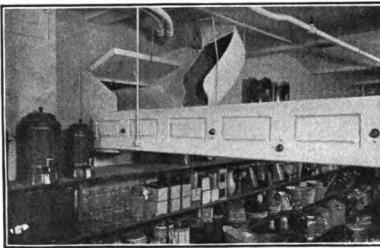
Constantly moving Baskets traveling on circuit lines and arranged to Sweep off Mail, Documents or Parcels from shelves and dump them into receiving chutes at required Receiving Stations. Made in Standard sizes as used by U. S. and Foreign Post Offices, or to Specifications.



Lamson Sweep-off and Dump Carriers for Post Office Work

### LAMSON BELT AND TRAY CONVEYORS

All sizes for all conditions of Mail, Merchandise or Parcel Carrying. Special Conveyor Belts to carry Trays are built with Arresting Stations by which a constant supply of material is automatically maintained at each Station. Particular attention to complete Belt Conveyor Systems for assembly of "Delivery" and "Transfer" Parcels in large Department Stores.

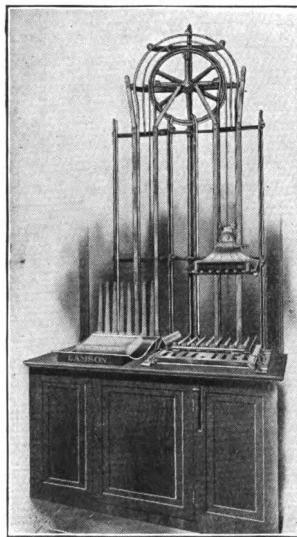


Store Service Belt Conveyor and Chute Showing Self-closing Fire Door

### SPECIAL CONVEYORS

Made to meet any demand for assembly and distribution of Mail or Merchandise within or between buildings.

Plans and Estimates Free.



### PICK-UP AND DELIVERY CARRIERS

Constantly moving metal "fingers" that noiselessly pick up documents or small articles from one tray or station and deliver them at another as desired. Made in standard sizes to meet special requirements.

*Representatives in all Principal Cities.*

Will pick up at any station and deliver at any other station

# STEPHENS-ADAMSON MFG. CO.

## AURORA, ILLINOIS

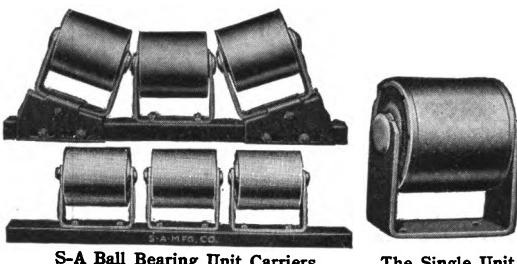
CHICAGO, NEW YORK, PITTSBURG, PORTLAND, ST. LOUIS,  
SAN FRANCISCO, LOS ANGELES, BIRMINGHAM.

### CONVEYING, SCREENING, AND TRANSMISSION MACHINERY

#### S-A BELT CONVEYORS

We are primarily conveying engineers, and our equipment is designed and manufactured to meet all special requirements. A most important feature of an economical conveyor system is the carrier. We present two types.

#### THE "S-A" BALL BEARING UNIT CARRIER



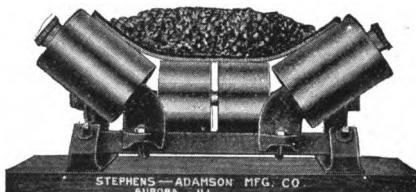
S-A Ball Bearing Unit Carriers

The Single Unit

This Unit Carrier has been developed to meet a consistent demand for an all steel ball bearing carrier with the obvious advantages of a carrier of this type. The single unit is the basis of its construction. Two, three, four or five of these Units may be combined to form a carrier of any width with the rolls arranged to suit any conditions. It is more easily adapted to different conditions than any carrier on the market. The troughers are adjustable to any angle and by means of additional units, the carrier may be easily and inexpensively enlarged to increase the capacity. The Units may be carried in stock as repair parts, the same as elevator buckets, etc.

#### STYLE No. 9 CARRIER

This carrier has direct lubrication from grease cups to well-babbited bearings outside the conveyor belt. Thousands of these carriers have been manufactured and shipped to all parts of the world. Many miles of conveyors are operating on these carriers and hundreds of large conveyor users have adopted them as standard. The bearings are absolutely dustproof and wear for years. Their strength has been equal to all demands.



Style No. 9 Carrier

#### THE "S-A" IMPROVED PIVOTED BUCKET CARRIER

##### The Power Plant Conveyor

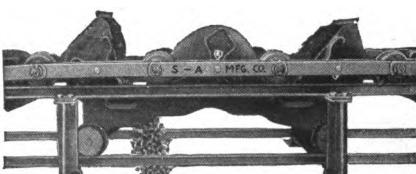
For handling coal and ashes in power plants, for handling cement clinker, etc.

**No Spill.** The lips of the buckets overlap perfectly, so that no particles of the material are spilled in transit.

**Perfect Discharge.** Each bucket turns completely over at the tripper, loosening sticky material and emptying the last particles of dust or grit.

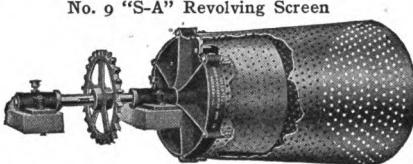
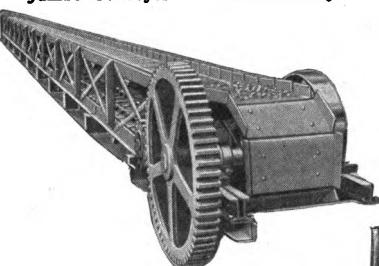
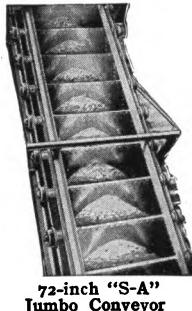
**Malleable Iron Buckets.** The buckets are not affected by temperature. Grit cannot wear the buckets or get into the bearings.

**Perfect Alignment.** The supporting shaft of each bucket passes thru both links of each chain and holds the chains in their proper upright position.



S-A Improved Pivoted Bucket Carrier

## STEPHENS-ADAMSON MFG. CO.



### GRAVEL WASHING AND ROCK CRUSHING EQUIPMENT

We have designed and equipped hundreds of these plants—commercially successful—in all parts of the country. The steel pan conveyor illustrated here, which is the largest ever built, is handling crushed stone in the plant of the Tomkins Cove Stone Company. It handles a capacity of 1,000 tons per hour up an incline of 45 degrees. The steel buckets are six feet in length and are supported by graphite-bushed self-lubricating steel rollers connected by double steel bar link chains. Many of our large conveyors of this type are in use throughout the country.

#### "S-A" STEEL PAN CONVEYORS

To meet the increasing demand for conveyors of large capacity and reliability, we build several types of steel pan conveyors. These conveyors are absolutely reliable and produce high conveying economy.

#### PROTECTED SCREW TAKE-UPS

This style of take-up has a standard bearing mounted on a steel angle base. The angle protects the screw, brings the bearing lower and makes a more powerful and compact take-up than any other type.

#### "S-A" REVOLVING SCREENS

This type of revolving screen is designed for the severest crushing plant service. We also make many types of screens for lighter service.

#### "S-A" IMPROVED GILBERT SCREEN

The standard screen for washing sand and gravel. The inner skirt takes the greatest wear and triples the life of the outer screen.

#### OUR MANUFACTURES AS ILLUSTRATED IN OUR GENERAL CATALOG INCLUDE THE FOLLOWING LINES

Bearings	Coal Handling Equipment for pockets, power stations, washeries and tipples	Gears
Belt Conveyors for all applications	Gravel Plant Equipment, washing and screening	Glass Works Conveyors
Brushes, Revolving, for conveyors	Coal Crushers	Hangers
Buckets, Elevator, steel and malleable	Conveyors, belt, pan, chain for handling ore, coal, ashes, gravel, crushed rock, clay, cement, and all bulk or packaged products	Pillow Blocks
Cars	Elevators, chain and belt, for all applications	Pulleys
Car Hauls	Feeders, conveyor, apron, roll and shaking Gates	Screens, shaking and revolving for all applications
Car Pullers and movers		Sheaves
Chains, standard detachable, malleable and steel of all types		Spouts
Clutches, friction and jaw		Sprockets
		Transmission Systems and Equipment

**THE TRENTON IRON COMPANY**  
**TRENTON, NEW JERSEY**  
**MANUFACTURERS OF THE BLEICHERT SYSTEM OF**  
**AERIAL TRAMWAYS**

The Bleichert System of Aerial Tramways is one whereby the material is carried in receptacles suspended from carriages running on stationary overhead cables in a continuous circuit, the loaded carriers along one cable and the empties returning along a lighter cable parallel with this, motion being imparted by means of a light endless traction rope to which the carriers are gripped.

No matter what the contour of the ground a Bleichert tramway will take the material in a bee line from where it is produced to where it is to be delivered without rehandling at a cost of 2 cents to 5 cents per ton a mile.

Angles may be made wherever it is necessary to change the direction of the line, but should be avoided wherever possible as adding to the first cost of the line and nearly always to the cost of operating.

Intermediate loading and discharge stations can be introduced at suitable locations if required, also intermediate brake or power stations according as power is developed or required, in cases where it is necessary to divide the line into sections.

No ground is too rugged for a bee line route; no grades too steep to surmount; no rivers or valleys too wide to cross; no grading, bridges or viaducts are required.

Structures are required to support the cables. These may be spaced varying distances apart according to the contour of the ground and structures are also required for applying tension to the track cables, wherever necessary in the longer lines to maintain their proper deflection. The supports may be of wood or of iron as preferred and are designed to correspond with the service and special condition of the location.

There is practically no limit to the length of a Bleichert Tramway. One



Fig. 1 Support in Bleichert Tramway

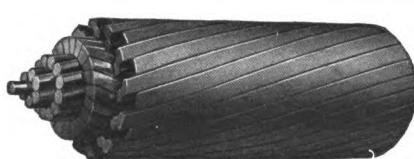


Fig. 2 Patent Locked Coil Track Cable



Fig. 3 Patent Coupling

line carries ore a distance of 21 miles. The loading terminal is 11,600 ft. above the discharge terminal and the capacity of the line is 40 tons per hour.

Spans occur in this line exceeding half a mile in the clear. Spans over 1000 ft. in any line are not unusual but the spacing of the supports under ordinary conditions will average 200 to 300 ft.

The track cables are of patented locked-coil construction (Fig. 2)

## THE BLEICHERT SYSTEM OF AERIAL TRAMWAYS

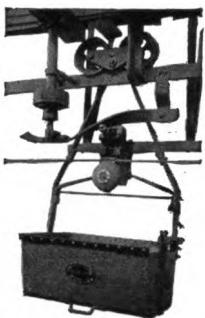


Fig. 4 Carrier with Webster Patent Compression Grip, showing patent automatic attacher

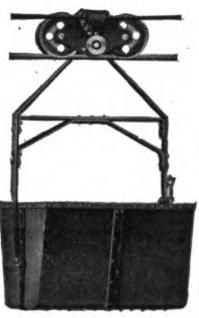


Fig. 5 Carrier with Bleichert Patent Automatic Overhead Grip

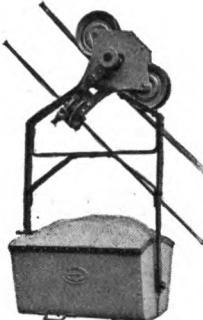


Fig. 6 Carrier with Bleichert Patent Automatic Underhung Grip

the smooth surface of which conduces toward a very uniform wear, which adds to the life of the cable and of the wheels that run on it.

These cables are made of a select grade of steel, in lengths varying from 500 to 1500 ft. which are joined by patented steel couplings illustrated in Fig. 3.

The grips for attaching the carriers to the traction rope are simple in construction, powerful, strong and efficient.

They are made for ropes running below or above the track cables according to the exigencies of the case, as shown in the cuts above. Fig. 4 represents the ordinary form of carrier with underhung grip suspended from a terminal rail, in the act of being mechanically attached to the traction rope. Fig. 5, a carrier with the Bleichert patent automatic overhead grip; and Fig. 6 a carrier with the Bleichert patent automatic underhung grip.

In the latter two the grips form an integral part of the carriage construction and operate in such a way that the weight of the carriers in any case acts as the gripping force in closing the jaws against the rope. These grips, therefore, are independent of any nice adjustment of the jaws and automatically accommodate themselves to irregularities of the rope which is a great advantage in long lines.

An overhead grip with positive operating mechanism is also made.

Well tried devices are provided for attaching and detaching the grips automatically at the terminals and other stations as may be required.

No buttons, lugs, or knots of any kind are required on the traction rope. This fact adds greatly to the life of the rope, since the wear is distributed uniformly over the entire rope and not confined to certain spots.

The same advantage pertains to these grips as compared to permanent connections of any kind. The ability to strip the line readily of its carriers when occasion occurs for resplicing the traction rope, or while making repairs is of itself a very great advantage.

Receptacles especially designed for any purpose are made of all kinds of materials. Buckets are most commonly used as shown in the illustration above, and these may be self-dumping if desired.

By cars especially designed to hold one or more buckets, the material may be transferred to and from surface tracks at the stations without rehandling.

Scales are furnished, if desired, specially designed for weighing the loaded carriers, or counters for automatically registering the number transported.

## PHILADELPHIA TRAMRAIL CO.

PHILADELPHIA, PA.

OVERHEAD TRAMRAILS FOR FOUNDRIES, MACHINE SHOPS, PRINTING PRESS ROOMS, FACTORIES, STORAGE WAREHOUSES, CANNERIES, ABATTOIRS, PACKING HOUSES, ETC.



This illustration shows a section of an overhead I-beam trolley system, installed by us for the American Engineering Company, Philadelphia, Pa.

The system is employed in connection with electric cranes.

The cranes drop the rough castings around the loop extending into the main foundry building, from which they are conveyed with chain hoists and trolleys to the cleaning, chipping, pickling, milling and shipping departments.

From the shipping department the trolley tracks extend outside of the building at all loading doors and are loaded on the wagons for delivery by employing pneumatic hoists in connection with the trolleys.

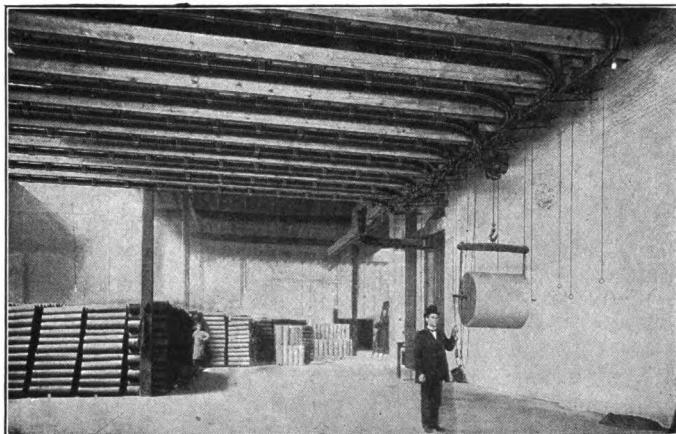
We are specialists in designing and installing overhead trolley systems, either flat bar or I-beam track, hand or electric operated, for conveying all kinds of materials.

Send for our catalogue No. 25, illustrating different systems, employed on different kinds of materials.

# RICHARDS-WILCOX MANUFACTURING CO.

AURORA, ILL.

OVERHEAD TROLLEY CARRYING SYSTEMS, AUTOMATIC FIRE DOOR FIXTURES;  
SLIDING DOOR HANGERS FOR WAREHOUSES, FACTORIES, ETC.



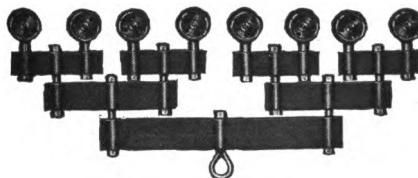
Typical Installation of Richards-Wilcox Overhead Trolley Track

The illustration above shows a typical arrangement of Richards-Wilcox Overhead Trolley Tracks in a large factory. The construction of this track is such that it is impossible for a carrier to drop out, and an ample factor of safety is provided against breakdowns.

Perfect flexibility is assured by a system of switches and turntables which provide for any desired arrangement of tracks.

These switches and turntables are absolutely "Fool-Proof" in that their construction leaves no possibility for carriers to drop no matter how turned or in what position.

## CARRIERS



Sixteen-wheel carrier, capacity 4,000 pounds, runs in No. 33 track. Eight-wheel carrier, capacity 2,000 pounds, runs in No. 33 track

Carriers are built with hardened roller bearings, also with hardened ball bearings in five regular sizes having capacities up to 4000 lbs. as indicated by the table herewith, and can be run around curves of 24" radius. A larger radius is advised, however, when it can be used.

Illustrated catalogs and full information concerning standard or special layouts and designs furnished on request.

## *Electric Grab-Bucket Cranes*

# SPRAGUE ELECTRIC WORKS

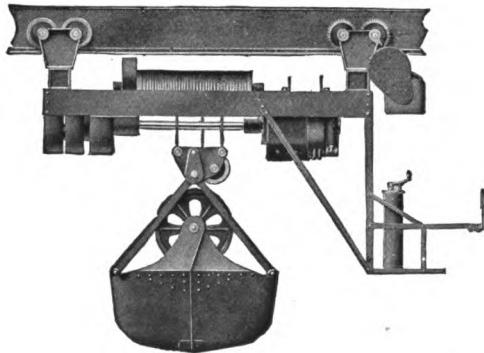
Of General Electric Company.

MAIN OFFICE:

527-531 WEST 34TH STREET, NEW YORK, N. Y.

ELECTRIC HOISTS, SWITCHBOARDS, GENERATORS, CONTROLLERS,  
MOTORS, DYNAMOMETERS, ELECTRIC FREIGHT  
HANDLING MACHINERY

### ELECTRIC GRAB-BUCKET CRANES



The Grab-Bucket Power Crane can shovel, lift, convey, deposit and pile and it is the only self-contained machine that can perform all of these operations.

In the G. B.-9 Crane illustrated above is found the very latest and most practical development of this machine. An entirely new principle is embodied in the design which simplifies manufacture, operation and repairs; and permits the sale of a high class machine at a moderate price. The construction has been so simplified that one motor and controller operates both the holding and lacing drums, while all hand or foot-operated brakes, clutches or levers have been eliminated. All gears are entirely enclosed and run in oil.

### ELECTRIC HOISTS

The Sprague Electric Works has for many years manufactured a complete line of Electric Hoists in capacities from one half to six tons. This line includes the Type S-1, one ton electric hoist, that has proved by years of practical service its unusual efficiency and adaptability for service in machine shops, foundries, warehouses and storerooms and for handling paper rolls in printing plants. In addition there are Monorail Cranes with operator's cages and Vertical and Horizontal Electric Winches. Complete information concerning any of this apparatus will be sent upon request.

## LINK-BELT COMPANY

PHILADELPHIA

CHICAGO

INDIANAPOLIS

NEW YORK, 299 Broadway

PITTSBURGH, 1501-3 Park Bldg.

ST. LOUIS, Central Nat'l Bank Bldg.

BUFFALO, 601 Ellicott Sq.

BOSTON, 131 State St.

SEATTLE, E. G. Brabrook

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NEW ORLEANS, Wilmot Mehy. Co.

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### ELEVATING AND CONVEYING MACHINERY FOR EVERY PURPOSE

#### **OUR MANUFACTURES INCLUDE**

Complete Coal Tipple Equipments

Coal Washeries

Slack Conveyors

Car-Hauls

Coal Pockets

Coal Crushers

Picking Tables

Screens, Chutes

Hoppers

Screw Conveyors

Crushed Stone, Sand and Gravel Handling Plants

Elevators, Screens, and Dredges, for Placer Mining

Locomotive Coaling Stations

Locomotive Cranes

Telphers

20th Century Asphalt Paving Machine

Industrial Railways

Power House Fueling Equipments

Roll Crushers of all types for Coal, Coke, etc.

Elevators and Conveyors for every purpose

Power-Transmission Machinery

Original "Ewart" Detachable Link-Belt Chains, all types attachments

Hangers, Pillow Blocks, Friction-Clutches, Flint Rim Sprocket Wheels, etc.

---

#### **The following catalogs sent on request**

No. 90 400 page General Price List

No. 78 Retail Coal Pockets

No. 81 Peck Carrier

No. 83 Conveyors for Freight and Packages

No. 95 Conveying Machinery for Coal Mines

No. 96 Conveying Machinery for Sugar Estates

No. 102 Maximum Silent Chain

No. 121 Friction Clutches

## *Elevating, Conveying, and Power Transmitting Machinery*

### THE JEFFREY MANUFACTURING CO.

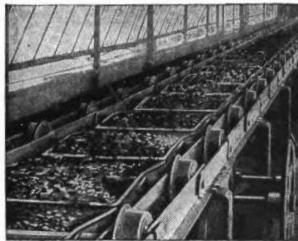
COLUMBUS, O.

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### ELEVATING, CONVEYING AND POWER TRANSMISSION MACHINERY



#### JEFFREY OVERLAPPING-LIP PIVOTED BUCKET ELEVATOR-CONVEYER

for handling Coal, Ashes, Cement, Sand, Stone, Ore and other materials.

Designed and built to meet conditions.

Write for Catalog 32-A.



#### JEFFREY CHAINS

are interchangeable with all other makes of Standard Link Chains of corresponding styles and numbers. Made of highest grade material, insuring uniform strength, pitch and surface finish.

Special Chains made to order.



#### RUBBER BELT CONVEYOR

for handling all kinds of material.

Superior in design and construction. Cost of installation, operation and upkeep is low.



#### APRON CONVEYERS

made in sizes and weights to meet all requirements. Built with wood or steel slats.



#### JEFFREY STORAGE BATTERY TRUCKS

save time, labor and expense in handling material in Industrial Plants.

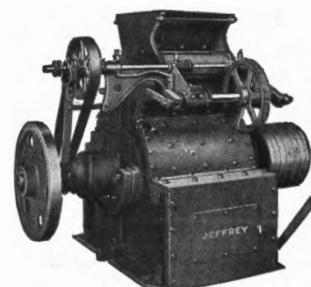
No skilled labor required to care for battery or truck. Battery will operate from one to two days on a single charge.

Bulletin No. 13-A and prices furnished on request.



#### BUCKET ELEVATORS

for handling Coal, Stone, Ore, Sand, Gravel, etc. Made in styles and sizes to meet conditions.



#### JEFFREY SWING HAMMER PULVERIZER

for reducing Limestone, Shale, Ores, Fireclay, Phosphate Rock, etc.

Has larger capacity, yields a more uniformly fine product, consumes less power and costs less for upkeep than any machine of its kind.

Request Catalog 31-C.



#### SPIRAL CONVEYERS

for handling Sand, Cement, Coal, Stone, Ores, Grain, Seed, Fertilizer Materials, etc., are strong and reliable.



#### JEFFREY SCREENS

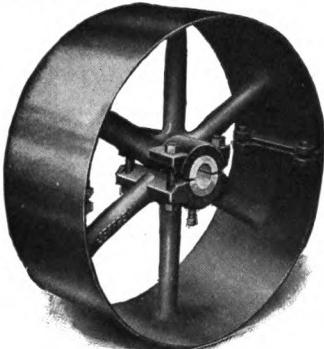
for treating Coal, Stone, Ore, Sand, Gravel, etc. Made in all sizes, Round or Hexagonal, of wire cloth or Perforated Plate.

Screen Catalog 69-B mailed on request.

# Elevating, Conveying, and Power Transmitting Machinery

## THE JEFFREY MANUFACTURING CO.

Complete Line of Jeffrey Elevating, Conveying and Power Transmitting Appliances, as summarized below, are shown in the following Catalogs and Bulletins, which may be had upon request:



**JEFFREY NEW IMPROVED SPLIT IRON PULLEY**

with Interchangeable Bushings. Saves Time, Labor and Expense. Minimizes Power Loss.



**JEFFREY TRAY ELEVATORS**

for handling barrels, bags, boxes and miscellaneous packages.

Automatically load or discharge material on any floor of building.



**JEFFREY ROPE DRIVE SYSTEMS**

are correctly designed by Expert Engineers.

We build them in both American and English Systems.

### JEFFREY PRODUCTS Catalog Nos.

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Coal Cutting Machines.....	18
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Coal Pocket Equipments.....	25-A
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## *Elevating, Conveying, and Power Transmitting Machinery*

### **WELLER MANUFACTURING CO.**

CHICAGO, ILLINOIS

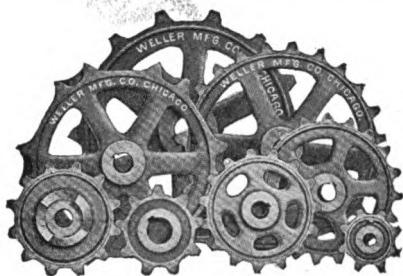
**ENGINEERS, FOUNDERS, MACHINISTS AND SHEET METAL WORKERS. MANUFACTURERS OF ELEVATING, CONVEYING AND POWER TRANSMITTING MACHINERY. COMPLETE GRAIN ELEVATOR EQUIPMENTS**

The complete catalog of the Weller Manufacturing Co., covering a complete line of elevating, conveying and power transmitting appliances, comprises a volume of more than 500 pages. We have endeavored to give in the following list, however, enough to indicate the range of their activities in these lines.

Angle plates for bevel and miter gears  
Apron Conveyors  
Barrel Elevators  
Bearings, ring oiling, chain oiling, self oiling  
Belt tighteners  
Belting, Rubber, Canvas, Leather.  
Blocks, Tackle  
Buckets, Elevator  
Cars, Steel Dump  
Chain, Case hardened steel bushed, combination steel and malleable, detachable lock pirtle, etc., etc.  
Clutches, Friction, Square and Spiral Jaw  
Collars  
Conveyors, Belt, Spiral, Endless Chain  
Couplings, Compression, Flanged face, Universal  
Dump Cars  
Elevator Appliances, including Buckets, Boots, heads, legging both steel and Wood, Power shovels, etc., etc.  
Fans, for elevator heads, steel plate exhaust  
Friction Clutches  
Friction Hoists  
Friction Wheels  
Gears, Spur, Bevel, Cogs, Worm, etc.  
Grease Cups  
Hangers, Drop, Post  
Hoists, American Safety rope, double drum, Moore anti-friction chain, single drum friction  
Jack Screws, Locomotive  
Link Belting and attachments  
Manila Rope Transmission appliances  
Oil Burners  
Paper Frictions  
Perforated Metal  
Pillow Blocks  
Pipe, plain riveted, spiral riveted  
Power Shovels  
Pulleys, cast iron, head, friction clutch, steel split, wood split, etc.  
Shafting  
Sheaves, manila rope transmission, wire rope transmission, wire rope hoisting  
Sprocket Wheels  
Spur Rack and Pinion  
Take up Boxes  
Tension Carriages  
Trippers for Belt Conveyors  
Winches, Hand and Power  
Wire Cloth

# Elevating, Conveying, and Power Transmitting Machinery

## WELLER MANUFACTURING COMPANY



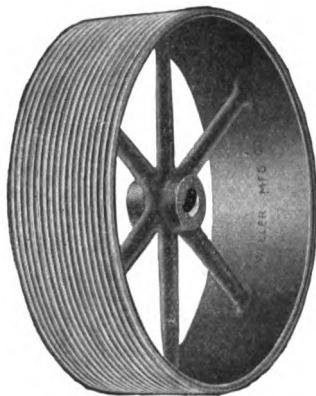
Sprockets



Gears



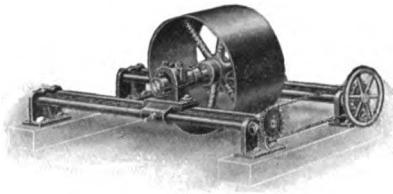
Pulleys



Sheaves



Dump Cars



Belt Tighteners



Pillow Blocks



Hangers

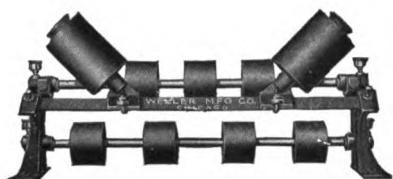
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**WELLER MANUFACTURING COMPANY**

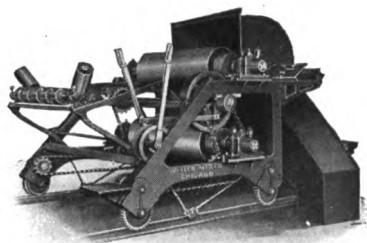
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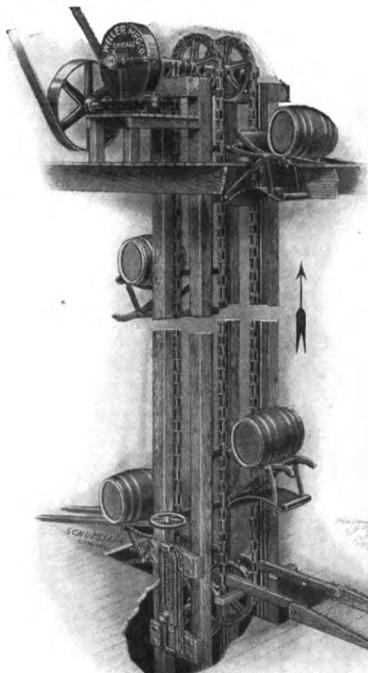
Spiral Screw Conveyor



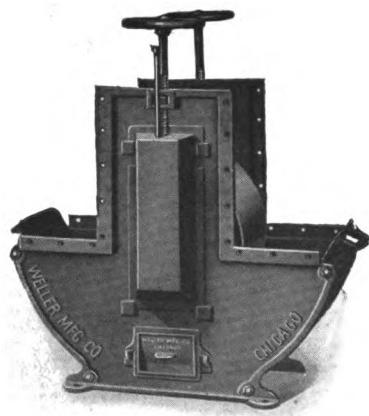
Belt Conveyor Troughing Rolls



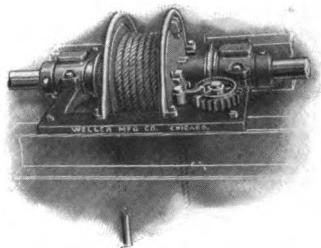
Trippers



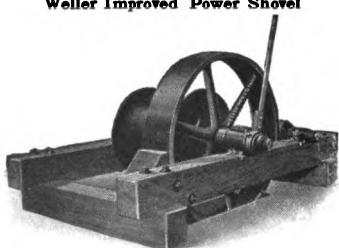
Barrel Elevator



Standard C.I. Elevator Boot



Weller Improved Power Shovel



Friction Hoist

## VULCAN IRON WORKS

WILKES-BARRE, PA.

LOCOMOTIVES, HOISTING AND HAULAGE ENGINES,  
AIR COMPRESSORS, MINING AND CEMENT MACHINERY

### LOCOMOTIVES

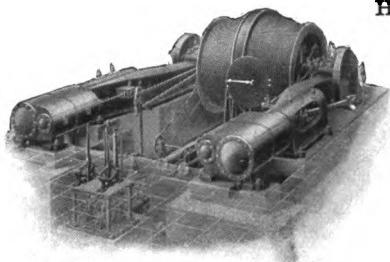
**Steam Locomotives.** The Vulcan Iron Works make a specialty of, and have excellent facilities for, building locomotives to meet the needs of contractors, steel, mining, and industrial plants; and for plantation, logging, freight, switching and passenger service, in all styles and weights from seven to seventy tons on drivers. A separate and complete plant is devoted to this work.



We also endeavor to keep on hand full detail parts of standard types with a view of making deliveries on short notice. Our stock locomotives can be forwarded on receipt of lettering instructions.

Complete illustrated catalog on request.

**Compressed Air Locomotives** are adapted to general service in and around coal mines, or industrial plants where a fired locomotive would be dangerous. The dimensions, pressure and capacity of the tanks may be modified to suit special requirements and conditions. For very long runs a separate air tender can be provided, which may be attached or detached as desired. Detailed information on request.



### HOISTING AND HAULAGE ENGINES.

**First Motion Hoists.** These engines are built to the most rigid specifications for heavy hoisting work. The drums are of steel or iron, grooved and conical in shape so as to counterbalance the weight of the rope. The illustration shows a type used for shaft hoisting from 300 to 1000 ft. lifts fitted with steam reverse, steam brake, and the Nicholson Engine stop for the prevention of overwinding. Special catalog on request.

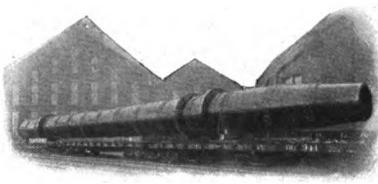
**Geared Engines.** Vulcan Geared Engines are used ordinarily where a hoisting speed of 800 ft. per minute or less is satisfactory, and for some purposes are preferred over First Motion Hoists because of the lesser first cost and of the smaller space occupied. These engines are simple and compact, but have ample proportions in all working parts so as to insure great durability and consequent low cost of maintenance. Special catalog on request.

**Vulcan Electric Hoists.** Vulcan Electric Hoists are built in standard sizes from 35 to 250 H.P. and with single or double drums. Special hoists will be designed to meet special conditions as may be required. If desired the equipment includes solenoid brakes and a device for the prevention of overwinding.

### MACHINERY FOR THE MANUFACTURE OF PORTLAND CEMENT

We build Kilns for either the dry or wet process, and of any size to suit the needs or ideas of the customer. Although our specialty is rotary kilns, dryers and coolers, we also build engines, boilers, stacks, bins, sheet iron work of all kinds, conveying and elevating machinery, and other machinery used in or around the Modern Portland Cement Plant.

Catalog on request.

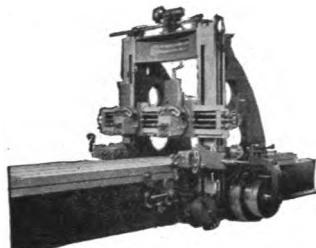


## Metal Planers

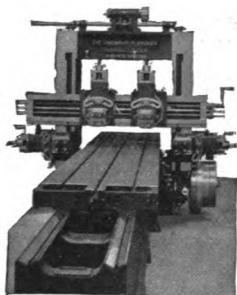
# THE CINCINNATI PLANER CO.

## CINCINNATI, OHIO.

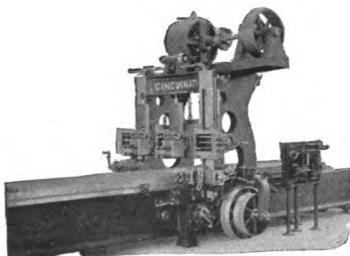
### METAL PLANERS



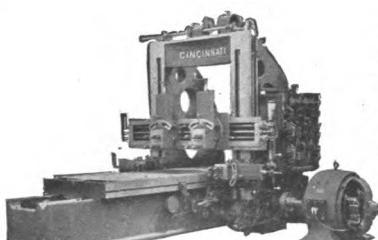
Standard Planer



Widened Planer



Variable Speed Planer



Motor Driven Planer

#### CINCINNATI STANDARD PLANERS

Cincinnati Standard Planers are designed for strength, rigidity, durability, convenience in operation, and adaptability for all classes of work required on a planer.

THE BEDS are of a heavy deep box section of great width through the body, and are especially strengthened where the gearing and uprights are mounted. The length has been increased, being now one and two thirds longer than the table.

THE TABLES are of unusual thickness and are braced at short intervals with heavy ribs, thus preventing any possibility of springing under any circumstances.

CROSS RAILS are of great depth, and have an extra deep box brace on the back to give additional stiffness, and are accurately scraped to straight edges and surface plates.

THE HEADS are distinctive, the ends of tool blocks and slides being made round to avoid projecting corners on angular work. They are carefully scraped to the rail, and are graduated for swivelling up to ninety degrees. They have automatic feeds in all directions, and can be operated from either side of the machine. The saddles being right and left, the tools can be run very close together.

MICROMETER ADJUSTMENT is furnished on all down feed screws. This consists of a collar graduated into thousandths, and will be found a great convenience for obtaining certain depths of cut rapidly and accurately.

THE GEARING AND RACK are of extra wide face, and are accurately cut from the solid by a system of special cutters for each gear. This gives a smooth running machine capable of producing the most accurate work, and insuring great strength and long wear. All the large gears and racks are made from semi-steel castings, and the pinions from steel forgings. All gearing is thoroughly covered for protection from chips and dirt.

#### CINCINNATI WIDENED PLANERS

There is a great variety of planing which does not require a standard machine, and manufacturers are rapidly recognizing the advantage of widened planers. It is not always advisable to buy a 48" x 48" Standard Planer simply because your work is 48" wide. In many cases a 36" planer widened to 48" will do the work better, as it is easier to handle and capable of higher speeds. We build these planers to suit your work, and have patterns for the various sizes given below.

Sizes—34" x 24", 36" x 30", 42" x 36", 48" x 36",  
56" x 42", 60" x 48", 72" x 48", 96" x 72",  
72" x 56".

#### CINCINNATI VARIABLE SPEED PLANERS

The greatest possible gain in planing comes from access to a change of cutting speeds. A correct speed for all materials and conditions, instantly available, is the secret of economy in planing. A planer operating at a speed of 20 ft. cut and 80 ft. return makes 960 cutting ft. per hour, at 40 ft. cut and 80 ft. return it makes 1600 cutting ft. per hour, a gain of nearly 70 per cent. Our variable speed planers are arranged for four cutting speeds up to 36 in. inclusive. The larger machines are arranged for six cutting speeds. The return of the table is always constant.

#### CINCINNATI MOTOR DRIVEN PLANERS

All Cincinnati Planers may be arranged for motor drive. Motors may be of either direct current or alternating current type.

# ROCKFORD DRILLING MACHINE CO.

ROCKFORD, ILL.

MANUFACTURERS OF  
UPRIGHT DRILLS, GANG DRILLS, AND LATHES.

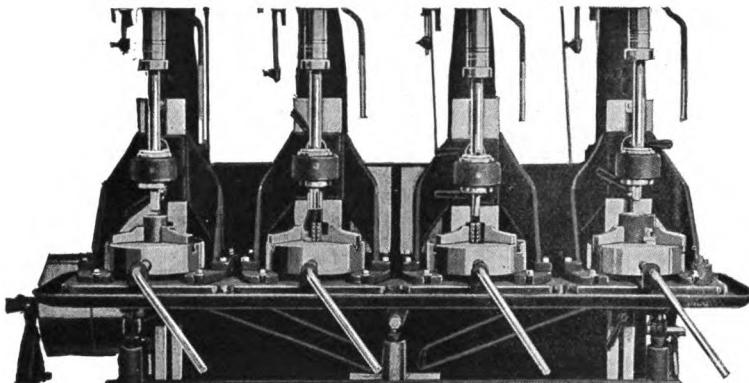


Illustration shows method of jigging and tooling a four spindle 23-inch gang drill for boring, facing one end, and reaming bushings.

## ROCKFORD GANG DRILLS

The vertical drill press may be used to great advantage for many operations ordinarily performed by the horizontal method, at the same time involving less investment and insuring equal or greater production and simple chucking and handling.

The secret lies in the proper jigging and tooling of the machine, gauging the number of spindles per operator to the time required for the longest operation and the loading and unloading of pieces.

Every second spent by the operator hanging onto a lever or waiting for the power feed to run through the cut is a second wasted, and sufficient spindles should be used per operator to keep his time fully occupied.

The reason for ganging spindles in groups is to place as many in front of the operator as he can keep busy, thus utilizing time that otherwise is wasted.

We manufacture a complete line of upright drill presses from 12" to 37" swing, and build upright drill presses in gangs of 2, 3, 4 and 6 spindles on the 14" and 20" sizes, and 2, 3 and 4 spindles on the sizes larger than the 20".

We construct four types of gang drills.

1st. Where a single table is used and the distance from spindle to table is the same in all cases.

2nd. Where a single table is used and the spindle bearings adjust to various heights. These two are of the box column type.

3rd. Independent columns having independent adjustable tables with spindle bearings stationary.

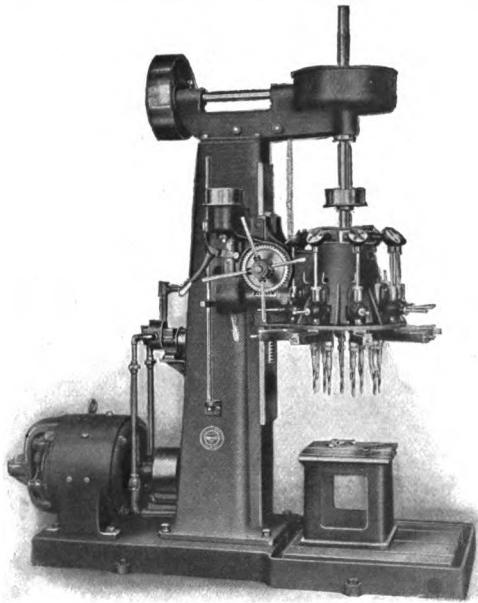
4th. Independent columns with adjustable tables and also adjustable spindle bearings.

A booklet illustrating various methods of jigging and tooling Rockford Gang Drills will be sent free on request, and if you will send us a blue print of your work giving material, operations, and required production, we will submit estimates free of charge.

## Drilling Machines

# BAUSH MACHINE TOOL COMPANY

SPRINGFIELD, MASS.  
New York Office: 50 Church St.  
**RADIAL AND MULTIPLE SPINDLE DRILLS**



All Geared Multi-Spindle Drill

The *All Geared* Multi-Spindle Drill here illustrated was brought out to cover a range of work where universal joints were not equal to the heavy strains necessary to get full service from the best high speed twist drills.

The substitution of gears for the universal joints permits a design of sufficient strength to operate high-speed twist drills of any make to their maximum capacity.

The Spindles can be set to drill any layout desired whether circular, square, rectangular, or in a straight line, and may be adapted to meet special requirements when desired.

The speeds on belt driven machines will be from a three step cone and when motor driven a 2 to 1 variable speed motor will be used.

The feed mechanism on head is of the most approved type, having steel and bronze gears throughout; the head can be operated by hand or power and has automatic knock-off with quick return by hand.

Drill spindles have three changes of gear feed per revolution of spindle.

All gears are made of steel or bronze, hardened where necessary and properly guarded.

All bearings are bronze bushed.

Spindles are furnished with ball thrust bearings.

Oil pump and circulating pipes, with automatic relief.

Each spindle has individual oiling arrangement with flexible tube.

Head is counterbalanced by weight inside of column.

### SPECIFICATIONS OF STANDARD MODELS

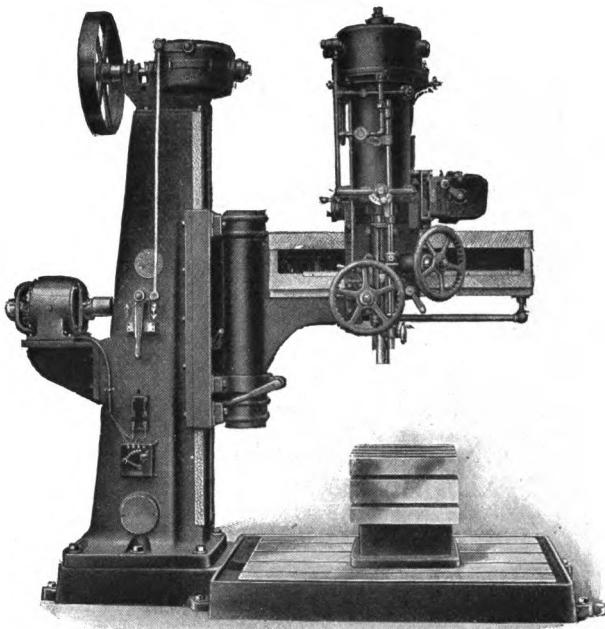
Model	No. of Spindles	Maximum Drill Used	Minimum Drill Used	Max. Circle with 8 Spindles	Min. Circle with 8 Spindles	Max. Sq. with 4 Spindles	Min. Sq. with 4 Spindles	Min. Dist. Center of Spindles	Max. Dist. from Spindles to Bed	Width of Belt Double	Max. Height	Floor Space	Net Width
1-A	8	1 $\frac{1}{2}$ "	1"	12"	4 $\frac{1}{2}$ "	8 $\frac{1}{4}$ "	2"	1 $\frac{3}{4}$ "	42"	4"	8'-10 $\frac{3}{4}$ "	3'x7 $\frac{1}{2}$ "	3600
4-A	8	1 $\frac{1}{2}$ "	1 $\frac{1}{2}$ "	18"	7 $\frac{1}{4}$ "	12 $\frac{3}{4}$ "	3 $\frac{1}{4}$ "	3 $\frac{1}{2}$ "	51"	8"	11'-9"	10'-9" $\frac{1}{2}$ x5'-2"	10900

## BAUSH MACHINE TOOL COMPANY

SPRINGFIELD, MASS.

New York Office, 50 Church Street

## RADIAL AND MULTIPLE SPINDLE DRILLS



Hydro-Pneumatic Radial Drill

The principle involved in the drilling head was worked out by the American Locomotive Company in anticipation of the now quite universal requirements for holes in boiler work drilled from the solid, instead of punching and reaming. The advantages are:

Direct application of a variable speed motor to rotate the spindle, in this way delivering nearly the whole torque of the motor at the point of the drill.

Feed by pneumatic pressure (at 80 lbs. per sq. in.) operating against an oil chamber, the flow from which determines the maximum advance of the drill. This combination gives a steady feed to the spindle and eliminates all danger of breakage from striking an extremely hard spot, or breaking through at the finish of the hole.

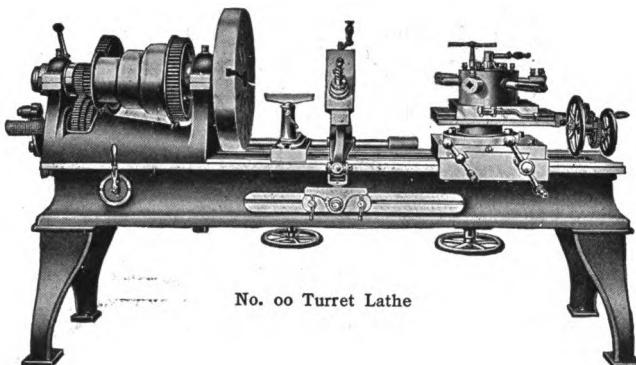
Other important features are, that the arm is equipped with a clamping device operated from the saddle, in fact all operating adjustments are on the saddle. All important bearings are either roller or ball bearing, and the spindle is high grade nickel chrome steel.

## SPECIFICATIONS OF STANDARD MODELS

Model	Well Drill in Center of	Traverse of Head on Arm	Maximum Ht. from Nose of Spindle to Base	Minimum Ht. from Nose of Spindle to Base	Spindle Speeds	Feed In. per Min.	Maximum Ht. of Machine	Maximum Length of Machine	Maximum Width of Machine	Size of Working Surface	Net Weight in cluding Motor and Table
4 ft.	111 in.	36 in.	62 in.	12 in.	50- 26-350	0 to 10 0 to 15	10'-9"	9'-7"	42 in.	36½ x 56½	7000
6 ft.	161 in.	56 in.	78 in.	23 in.	26-350		12'-6"	13'-8"	48 in.	42 x 83	12000

## AMERICAN TOOL AND MACHINE CO.

ESTABLISHED 1845

BOSTON, MASSACHUSETTS, U. S. A.  
LATHES, VALVE-MILLING MACHINES, OIL SEPARATORS

No. 00 Turret Lathe

**Turret Lathes (Nos. 00 and 0):** Intended for heavy brass and iron work, and rod work up to 2-in. diameter. The forward motion of the turret can be accelerated by simply throwing the lever, and so is available instantly for either quick or slow operation.

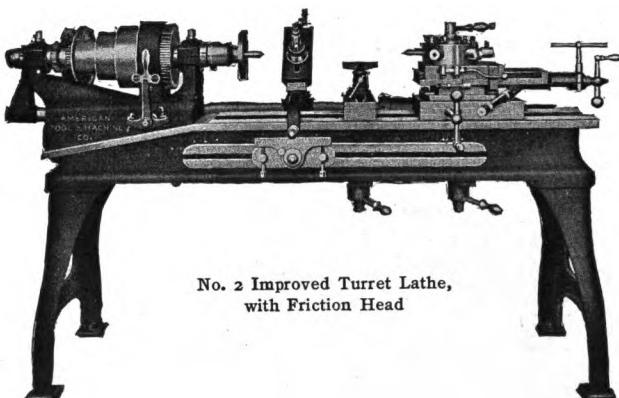
**Cabinet Turret Lathes (Nos. 1 and 2):** These lathes are exceedingly compact and firm, and not liable to spring and chatter. Especially suited for general service on "Chucked work." Head stock swivelled for boring taper holes with power feed.

**Friction Head:** For work requiring widely different speeds in its several operations, we have designed a friction head, so called. This combination enables the operator to use slow or back gear speeds by changing a lever.

Catalog containing full description, illustrations and specifications of lathes, sent on request.

No.	Actual Swing.	Length of Bed.	Spindle.	Takes Between Centers.	Fitted with		
TURRET LATHES.							
00	26 $\frac{3}{4}$	8 ft.	Hollow	46 in.	Back Gears	Screw Apparatus	Taper Attachm't
0	24	8 ft.	Solid	46 in.	"	"	"
1	18	6 ft.	Solid	33 in.	"	"	"
CABINET TURRET LATHES.							
1	20 $\frac{1}{4}$	7 ft.	Solid	34 in.	"	"	"
With Friction Head	20 $\frac{1}{4}$	7 ft.	Solid	34 in.	"	"	"
2	18 $\frac{1}{4}$	6 ft.	Solid	27 in.	"	"	"
IMPROVED TURRET LATHES.							
2	18 $\frac{1}{4}$	6 ft.	Hollow	34 in.	"	"	"
With Friction Head	18 $\frac{1}{4}$	6 ft.	Hollow	34 in.	"	"	"
1	17	6 ft.	Hollow	27 in.	"	"	"
IMPROVED LATHE							
1	15	6 ft.	Solid	26 in.	"	"	.....
2	13	5 ft.	Solid	27 in.	.....	"	.....
SQUARE ARBOR LATHE.							
2	13	5 ft.	Solid	27 in.	.....	.....	.....
3	12	5 ft.	Solid	26 in.	.....	.....	.....
SET OVER AND BACK MOTION LATHES.							

# AMERICAN TOOL AND MACHINE CO.



No. 2 Improved Turret Lathe,  
with Friction Head

**Improved Turret Lathe:** The headstock can almost instantly be raised to a level with that of the tail stock. The hollow spindle has a thrust bearing that runs continuously in oil, thus relieving the spindle of friction and wear.

Headstock fitted with self-oiling, hard metal, bronze boxes with hardened steel thrust and take-up, washers and adjustable caps.

Tailstock fitted with swivelling arrangement and quick motion device to top slide.

Screw apparatus, Fox design with six point star follower, hobb spindle revolves at half the speed of live spindle, insuring a strong and durable leading thread.

## OIL SEPARATORS

### Belt Driven

Made in two sizes. No. 1 has a capacity of 520 cubic inches, and will separate in from five to eight minutes, the time being regulated by the condition and quality of the oil used.

These same conditions apply to the No. 2 or larger machine, which has a pan capacity of 2,540 cubic inches, and is proportionately heavier and stronger. The time required to separate with the No.

2 is practically the same as with the No. 1, provided both are running at the same peripheral speed. The No. 2 separator (see cut), having about five times the capacity of the No. 1, is better adapted to bulky, light-weight chips or turnings, but is equally effective on ordinary work.

### Electrically Driven Separator

The No. 1 separator is mounted and geared for electric driving. Electric power is now in such general use for machine-shop work that this type of separator meets a demand from shops so equipped.

Direct Current Motors furnished for any voltage.



No. 2 Oil Separator

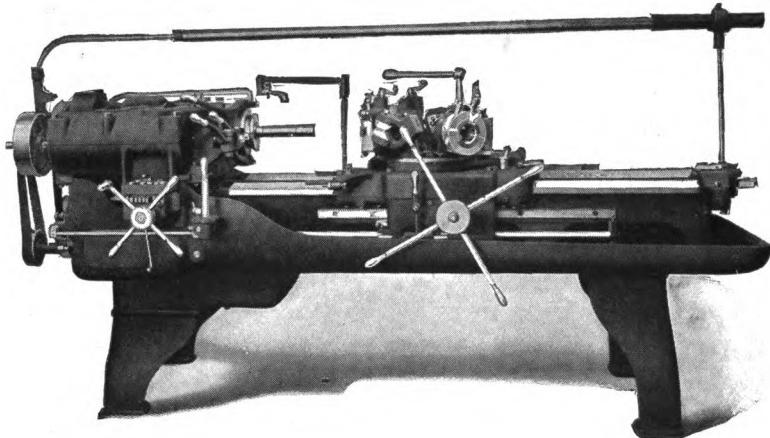
# JONES & LAMSON MACHINE COMPANY

SPRINGFIELD, VERMONT, U. S. A.

77 Queen Victoria St., London, England

## COST REDUCING MACHINES FOR LATHE WORK

### THE HARTNESS FLAT TURRET LATHE



Single Spindle Type

The Hartness Flat Turret Lathe which was originally designed for bar work exclusively has been growing as a machine for Chucking Work. This drift toward chuck work commenced with the introduction of the Cross Sliding Headstock in 1904 and has been particularly well warranted, for by this feature its working range was extended to that of Chuck Work without departing from the original cardinal principle of stability. This was accomplished by the unusual departure of mounting the headstock on a cross slide, thereby gaining a double motion for each tool in the turret, without giving up the ideal feature of Single Slide plan.

The Single Slide principle provides the most absolute control of the work and tool. It has certainly not been equalled by any of the other schemes which have had to resort to the use of two or more slides between the tool and the bed casting.

On this plan has been carried forward the success of the Flat Turret Lathe which began back in 1890 in our works, and to the success of which we humbly acknowledge our present attainment.

All through these years we have aimed to build a machine on ideal lines, both mechanically and economically—and for ourselves and our customers. Our claim has been set forth in our book, Machine Building for Profit, and our machines have been described in the Hartness Manual of the Flat Turret Lathe. Although these books were in the nature of advertising mediums, the facts were stated with the best degree of impartiality that could be held by earnest advocates.

Our Flat Turret Lathe today stands without a rival as the machine that gives the best independent control of work and tool, (and you know that that is the most

# JONES & LAMSON MACHINE COMPANY

SPRINGFIELD, VERMONT, U. S. A.

77 Queen Victoria St., London, England

## COST REDUCING MACHINES FOR LATHE WORK

### THE HARTNESS FLAT TURRET LATHE

Single Spindle Type

essential feature of a lathe for chuck work; if it were not, then you could do all your chuck work on a drill press at a great saving in cost of installation and labor cost per piece).

**It is the only machine that combines high efficiency with adaptability.** (The adaptability is the essential feature in any plant in which there is a progressive change in the design of its product. It is the feature that facilitates getting the work done when it is wanted. It is the feature that keeps down the cost of special tools, the immense capital tied up in parts, and the loss entailed by that large stock when on account of progress in design these parts have become obsolete.)

**It is the simplest machine.** (Simplicity cannot be overrated. The problems of the engineering world are intricate beyond the reach of the human mind, and any machine that is needlessly complex is a hindrance to progress. A simple machine for accomplishing an important work is one of the greatest blessings of the present day. It eliminates the worry about how to do the work. It facilitates the comprehension of the process. It brings the machine within the reach of the workman's understanding without his having to study a lifetime to know how to use it. In fact the simple machine is the machine of greatest value provided it meets the economic conditions.)

**It likewise possesses many other unique characteristics which were most easily acquired in the development of this type of lathe.** Easy, because we were the first in the field, and we took the natural means and selfishly patented them. This has not led to a public loss. It has led to the production of the greatest number of these machines by one manufacturer and this has made it possible to give a machine of the highest value at the lowest price. Machine builders know what gains can be made by this process, yet even they are frequently chagrined at our success.

**But all these facts are well known to our friends who have bought our machines, and many of our friends who have bought others. Just now, however, we are announcing something that may not be generally known.**

### WE HAVE MADE TWO NEW DEPARTURES

**First, we are making the Flat Turret Lathe in two styles.** The Regular style you know well. (It is made in two sizes. The smaller one is called the  $2\frac{1}{4} \times 24$  size. It handles bar work up to  $2\frac{1}{4}$  inches diameter of the bar from which the work is turned, and chuck work up to 12 inches in diameter and from 1 inch to 8 inches or 12 inches long, according to the character of the piece. The larger one is known as the  $3 \times 36$  Flat Turret Lathe, and it handles bars up to 3 inches diameter, and chuck work up to 14 inches and from 1 inch thick to 12 inches or 18 inches long, according to the character of the piece.)

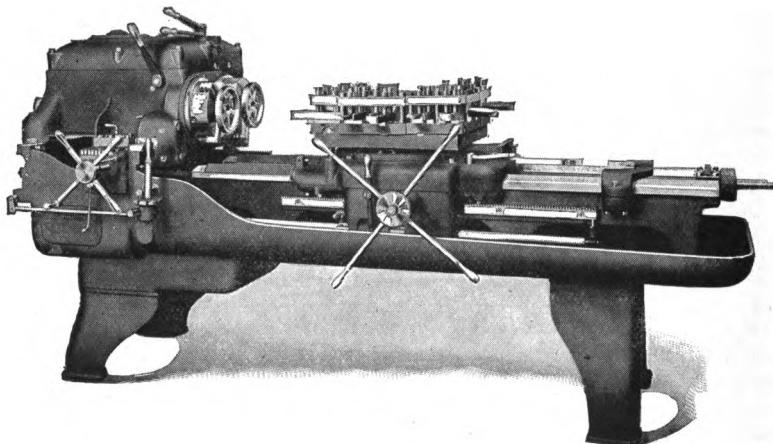
# JONES & LAMSON MACHINE COMPANY

SPRINGFIELD, VERMONT, U. S. A.

77 Queen Victoria St., London, England

## COST REDUCING MACHINES FOR LATHE WORK

### THE DOUBLE SPINDLE FLAT TURRET LATHE



Double Spindle Flat Turret Lathe

The New Machine will be known as The Double Spindle Flat Turret Lathe. It is designed primarily for chuck work. It may be used either as a single spindle or a double spindle lathe. When used Single it can carry a chuck of 17-inch diameter, and when both spindles are used the two chucks are 9-inch diameter. This double spindle is another step toward highest output per dollar of investment. It possesses many unique features especially contrived to get out large lots of work. For small lots of work the single spindle lathe should be used, or this machine should be used, with one instead of two spindles.

The Two Spindle Machine gets its output by the use of two sets of tools. It carries on two similar cuts at the same time. Since these cuts are exactly the same, the speeds and feeds may be the most advantageous, the long cuts being taken on both pieces at the same time, and the short cuts are also taken simultaneously. This, of course, has a distinct advantage over the machines of multi-spindles in which one set of tools must operate on all of the pieces, for in such machines the total time is a multiple of the longest operation divided by the number of spindles, whereas in the present scheme the total time is only the sum of all the operations divided by two, the short one counting only for the exact time required instead of counting as much as the longest one.

The simplicity of operation and the similar character of the two cuts results in a greater saving than is apparent at first glance. It will be readily appreciated by those who have been exasperated by the excessive compromises that must be made in some instances in producing work on the multi-spindle turret machines in which only one set of tools is used. The loss of time on some kinds of work is a serious handicap, especially on work which requires a great difference in time in the performing of the several operations.

# JONES & LAMSON MACHINE COMPANY

SPRINGFIELD, VERMONT, U. S. A.

77 Queen Victoria St., London, England

## COST REDUCING MACHINES FOR LATHE WORK

### THE DOUBLE SPINDLE FLAT TURRET LATHE

The advantages of the Double Spindle Flat Turret Lathe will be found to be many on many kinds of work, but of course it is designed more for manufacturing conditions of large repetition work than for conditions which call for quick change and small lots.

It gains its advantage over all other means not only on account of its double cuts of a kind, but it combines with the double spindle the advantages that go with a hand-operated lathe,—such as highest cutting speeds and feeds. These, of course, cannot be attained by an automatic machine that is not constantly under the watchful eye of the operator. The difference in speeds makes an important difference in output.

The Double Spindle Lathe also requires a little more care in setting the second set of tools so that they may act in harmony with the first set, but even this is minimized by the auxiliary adjustment provided for many of the tool holders; and another restriction is that with this doubling of tooling there is necessarily some restriction of the range of work, but it is nothing compared with the natural restrictions of other machines that are offered for manufacturing conditions. Hence this machine and our Regular Single Spindle Lathe still maintain the leading position as adaptable broad range machines, and these machines possess this desirable characteristic not by giving up their stability or convenience of control, but solely by well considered schemes of design, such as can only be brought forth by specialists.

For instance, let us look at the convenience of setting up the tools for turning a new piece of work on the Double Spindle. We will imagine we have a piece of chuck work about 8 inches in diameter, and, say about 4 inches wide, like a pulley, gear blank, or any similar piece which would require boring an inside hole, turning the outside diameter, facing the flange and hub, and perhaps turning the outside of the hub and inside of the flange and facing the web.

What is the most natural way to group these tools? What form of holding turret gives these tools the most stable support to resist the cutting stress? It seems to us that the most natural way to place these tools near the work previous to clamping them is to lay them down at the edge of a table with their cutting point projecting beyond that edge, just far enough to reach into or over the work, and that the best support for these tools would be such a table mounted solidly on a slide that will bring it up closely to the work so that there is no unnecessary overhang.

With such a thought in mind, we have given the Double Spindle Turret Lathe a square topped flat turret. The edges of its four sides may be presented one after the other to the work. Each edge may carry two sets of tools, the front set for the front spindle and the back set for the back spindle. These edges carry the tools which must have the most rigid and accurate support. (The four corners may be used for carrying drills, reamers, dies, taps or boring tools when working on one spindle at a time.)

Has there ever been presented a more ideal tool support for a Turret Lathe, both for meeting the most natural and convenient way of setting the tools for a new piece of work, and for the firmest control of these tools under working stress?

The means for clamping these tools to the top of the turret are the simplest, and, of course, the tools are likewise the simplest. Then, after that, the single slide scheme of operating reduces the uncertainty. For there is one handle that moves the turret carriage to and from the chuck, and another handle that moves the work-carrying headstock back and forth to get a change of diameter, and when either or both of these motions are made for one tool, we know that the other tool is similarly affected.

But we must go on with our story and give the second part of our announcement.

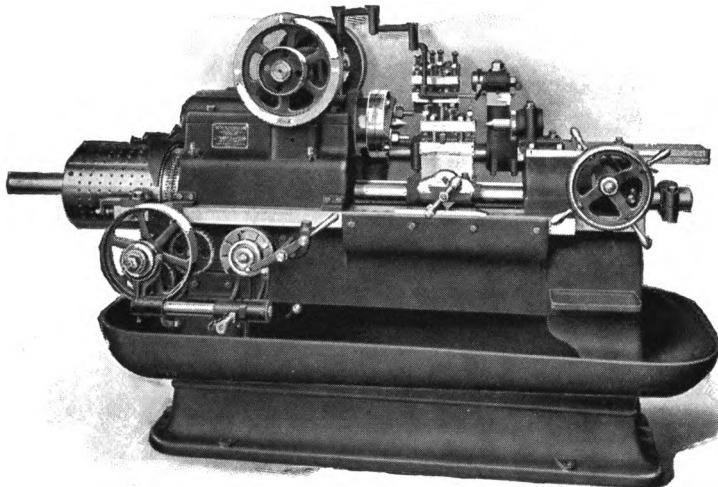
# JONES & LAMSON MACHINE COMPANY

SPRINGFIELD, VERMONT, U. S. A.

77 Queen Victoria St., London, England

## COST REDUCING MACHINES FOR LATHE WORK

### THE FAY AUTOMATIC LATHE



The Fay Automatic Lathe

The Fay Automatic Lathe is now built and sold by the Jones & Lamson Machine Co. in conjunction with the Flat Turret Lathe.

The best industrialists know that it is not good practice to duplicate the number of handlings of a piece of work in the machine shop and we have won a great part of our good name by offering a way to do chucking work so that the whole piece came from the machine fully turned. That is, in many cases; in fact, in most cases where the piece could be slightly remodeled to meet our conditions we have been able in the Flat Turret Lathe to bore, turn, face, and in fact, perform a variety of intricate lathe operations on a piece of work without ever taking it out of the chuck. In turning a gear blank, for example, we have turned the outside and both faces of the rim, we have faced the hubs and bored the hole perfectly true, all with one setting simply by holding the gear blank by chuck jaws that have gripped outwardly on the inner edge of the rim between the arms of the blank.

So many ways have been found to fully turn a piece of work at a single setting, or at least to turn all of those surfaces that should be absolutely true with each other, that a great saving in cost of such work has been effected by our machine. And it is a saving that every Superintendent of a machine shop appreciates, for he knows that it is almost impossible to re-chuck a piece of work so that it will run true with the cuts first taken. So difficult has this been that many sacrifices in design have been made just to provide a way to do all of the turning operations on a piece at one setting, thus ensuring absolute truth of the work.

# JONES & LAMSON MACHINE COMPANY

SPRINGFIELD, VERMONT, U. S. A.

77 Queen Victoria St., London, England

## COST REDUCING MACHINES FOR LATHE WORK

### THE FAY AUTOMATIC LATHE

But—there are pieces of work that must be turned on center point supports. That is, there are pieces of work that can best be supported on regular engine lathe center points. Some of these have no hole through them. In fact, some seem to combine the characteristics of both bar and chuck work and are so formed that there seems only one way to support them and that is on center points such as have been used in the good old engine lathe from the first days of its existence.

And it is to provide for this work that we have taken over the Fay Automatic Lathe. It is offered for work that must be turned on centers as an auxiliary for the Flat Turret Lathe.

The good feature about the center point support is that it is the means by which a piece may be taken out and a new piece put into a lathe in the shortest possible time. In other words, it is the quickest process of re-gripping a piece of chucking work. There are other quick ways, but they are lacking in accuracy. There is no "one way" for all pieces of work. There is, however, a one and only way that some pieces should be held, and it is for such pieces that should be held on centers that we are offering this machine.

The Fay Lathe is distinctly a center piece support automatic engine lathe for a certain range of work. It is in a class by itself, and is one of the simplest automatic machines for lathe work.

Although the stability of tool control is superior to many machines for automatic operation, it is not claimed that it approaches the ideal in this respect of the Flat Turret Lathe, but it is equally convenient for quick adjustment for any new piece of work, and it uses the very simplest of cutting tools. The success of this machine is attested by the batteries of them that have been installed by people who have had a chance to know of its merits.

It will be our purpose to furnish full information of this machine so that the work coming within its range may be done where it will be turned out at lowest cost and best advantage, for this is an important link in the lathe equipment of almost every manufacturing machine maker.

Remember, then, that the Jones & Lamson Machine Company of Springfield, Vermont, and London, England, are now building and selling the Double and Single Spindle Hartness Flat Turret Lathe, and The Fay Automatic Lathe for center point support work.

That the Hartness Flat Turret Lathes, Regular and the Double Spindle, are for chuck work as well as for bar work. That they cover chuck work up to 17-inch diameter, are built to give the best independent control of Work and Tools; the Highest Efficiency as profit producers from the investor's standpoint; the machines which give the greatest output when it is wanted, and which will produce almost any conceivable piece of work without special equipment.

The Regular Lathe is our standard machine for meeting the conditions found in machine building plants, such as automobile work, etc.

The Double Spindle meets the demand for the greatest output at expense of a little delay in "setting up" the machine for a new piece, (this delay being negligible on work which requires no change in tooling for periods of several days or more), and

The Fay Automatic Lathe is for work that must be supported on centers.

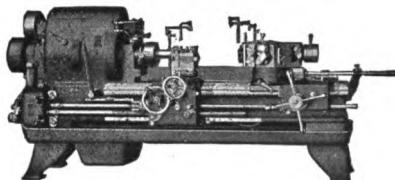
# THE WARNER & SWASEY COMPANY

*Works and Main Office : CLEVELAND, OHIO*

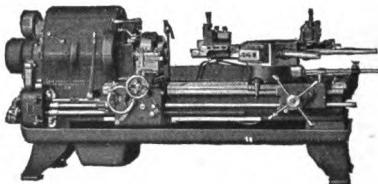
*Branch Offices : New York, Boston, Detroit and Chicago*

TURRET LATHES

TURRET SCREW MACHINES  
BRASS-WORKING MACHINE TOOLS



No. 3A—Tools for Bar Work

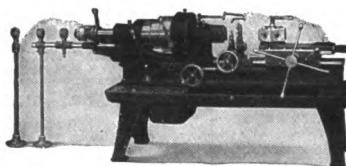


No. 3A—Tools for Chucking Work

## HOLLOW-HEXAGON TURRET LATHES

For the rapid, accurate and economical production of lathe work; from bar stock, forgings and castings. Complete tool equipments for bar and chucking work.

Four sizes: Automatic Chuck capacity,  $1\frac{1}{2}$  to  $4\frac{1}{8}$ "; length turned, 18 to 36"; swing over bed, 14 to 24".

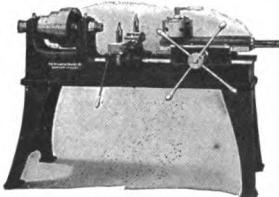


No. 6—Bar Capacity  $2\frac{1}{2}$ "; Swing, 18"

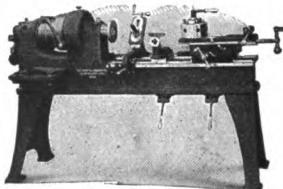
## TURRET SCREW MACHINES

Five sizes— $\frac{1}{2}$  to  $3\frac{5}{8}$ " automatic clutch capacity; 10 to 20" swing.

With or without automatic chuck; bar feed; automatic feed for turret; automatic feed for cut-off, etc.—every modern facility for rapid production.



Plain Turret Lathe



Universal Turret Lathe

## TURRET LATHES AND BRASS-WORKING MACHINE TOOLS

Turret Lathes—14 to 24" swing; Plain, Set-over or Universal turret; with or without Geared-friction Head, Automatic Chuck; Cut-off; Forming attachment; Chasing attachment, etc.

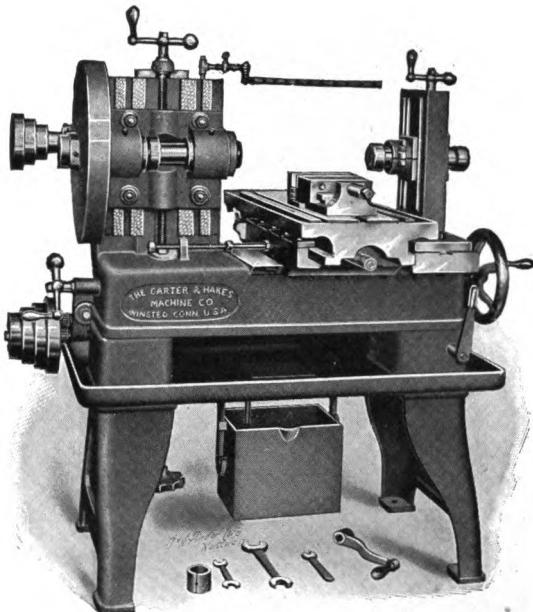
Automatic Boring and Tapping Machines; Valve Milling Machines; Key Lathes; Cock Grinders, etc.—for the manufacture of valves, cocks, fittings and similar work.

Equipments planned and estimates of outputs furnished upon request.

# THE CARTER & HAKES MACHINE COMPANY

WINSTED, CONN., U. S. A.

## MILLING MACHINES



No. 2 IMPROVED LINCOLN MILLING MACHINE

This machine, with the exception of the design of the head and upright on the bed, is of the well-known Lincoln type, with a number of improvements which should commend it to manufacturers using this class of machine.

The Bed and Upright which carry the head are cast in one piece and well braced where needed.

The Carriage is extra long affording ample support for the table at its extreme movements.

The Table is of ample proportions, and has three T-slots, also oil recess on either side and oil pan at each end.

The Head is gibbed on the side, and bolted to the upright with four  $\frac{3}{4}$  in. T-bolts. There is also a stop screw with lock nut underneath.

The Spindle is of special steel forged and runs in self-centering, adjustable composition bearings. The front bearing is taper; diameter at large end 3 in., length 5 in. Rear bearing  $2\frac{1}{8}$  in. diameter by 5 in. long. It has Browne & Sharpe No. 10 taper hole for arbor, also a  $\frac{3}{4}$  in. hole from bottom of taper its entire length. Spindle is geared 6 to 1 and has slot in front end to receive the driver on the cutter arbor.

The Foot Block Spindle has bronze bearing in either end to support outer end of cutter arbor, holes in these bearings being  $\frac{3}{4}$  in. and 1 in. The bearing for this spindle is also provided with a bronze bush, so that when taking extra heavy cuts, the arbor can be supported from the outside diameter by using a special collar on the cutter arbor.

The Vise is fitted with steel jaws, which are  $6\frac{1}{4}$  in. long by  $1\frac{1}{4}$  in. deep, and will open  $3\frac{1}{4}$  in.

Each machine is furnished with a vise, countershaft and wrenches. The automatic quick return for table, oil pump and tank, cutter arbor, and extra parts for two speed countershaft can be furnished if desired.

Circulars fully describing machine, also Automatic Punch Return, sent on application.

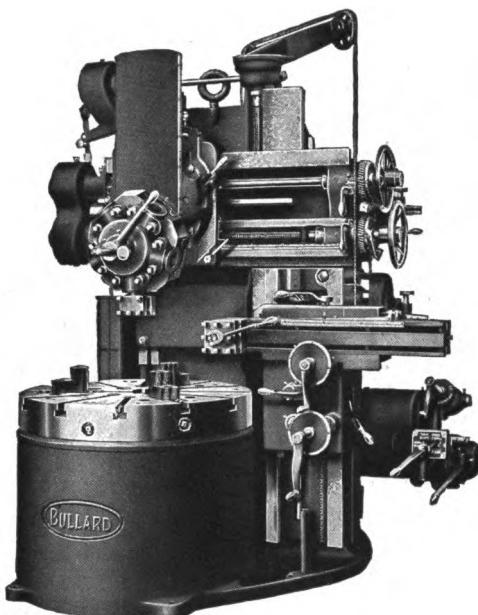
## *Vertical Turret Lathes*

# THE BULLARD MACHINE TOOL COMPANY

BRIDGEPORT, CONN., U. S. A.

### THE VERTICAL TURRET LATHE

(New Era Type, Patented)



The Vertical Turret Lathe is a "boring, turning and facing machine," essentially original in design, in the development of which especial consideration was given to the elimination of wasted time in machine operation,—a decidedly large factor in productive capacity.

The basic feature of its design lies in the disposition, at a right angle to each other, of two universally and independently movable tool-carrying heads.

The Main Turret Head is mounted on a horizontal cross rail (as in the construction of the Vertical Boring and Turning Mill), and the Side Turret Head (similar to the tool carriage of a lathe) is supported by a *vertical* side rail; both rails forming a unit which is adjustably mounted on the Bed or Column, in the base of which is supported the table spindle and the entire driving and speed change mechanism—the whole forming a compact and self-contained unit of extreme strength and rigidity.

The unique disposition of the two Heads permits the *simultaneous machining of contiguous surfaces* without interference between Heads or Tools, and the two Turrets will hold in instant readiness all tools required for an entire sequence of operations.

The independent universal movements of *both* Heads simplifies the tool equipment required for a wide range and variety of work—the same tools (excepting reamers) being used for all work of the same type coming within the range of the machine.

#### OPERATIVE FEATURES

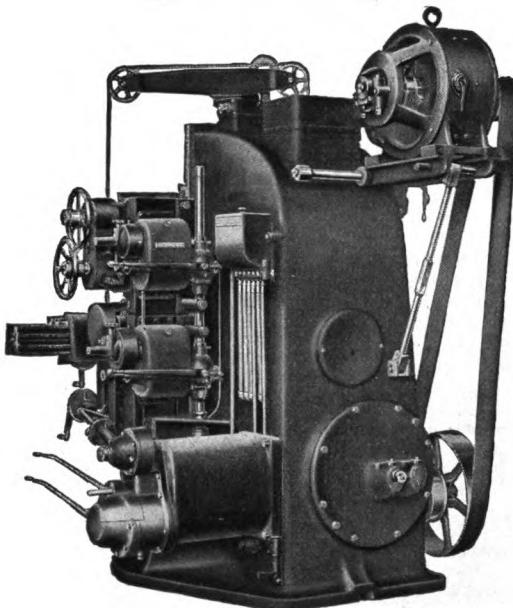
Which Eliminate Wasted Time

VERTICAL CONSTRUCTION—easy chucking with *gravity* as an aid.  
QUICK SPEED CHANGE—the *right speed easily maintained*.

# THE BULLARD MACHINE TOOL COMPANY

BRIDGEPORT, CONN., U. S. A.

**THE VERTICAL TURRET LATHE**  
(New Era Type, Patented)



QUICK ACTING BRAKE eliminates *idle* table revolutions.  
RAPID POWER TRAVERSE conserves the operator's energy.  
CENTRALIZED CONTROL is *perfect* control—no long reaches or false moves.  
LARGE MICROMETER DIALS are easily read in taking measurements.  
OBSERVATION STOPS simplify the duplication of *various* sizes in repetition work.

## STRUCTURAL FEATURES Which Reduce Maintenance Cost

SINGLE PULLEY DRIVE at constant speed obtaining highest efficiency and longest life from belting.

MULTIPLE DISC CLUTCH running at constant speed maintains maximum efficiency regardless of table speed. Amply proportioned for heaviest duty and readily adjustable for wear.

ALLOY STEEL GEARS, throughout driving and feed train, heat-treated to 260,000 lbs. tensile and 245,000 lbs. elastic are practicably indestructible through either breakage or wear.

CONTINUOUS FLOW LUBRICATION of all bearings and gears insures highest power efficiency and immeasurably increased life of parts and obviates possibility of breakage and delay due to carelessness of operator in failing to fill any one of a "hundred and one" oil holes.

IMPROVED TURRET INDEXING, differing radically from standard construction, maintains accuracy of alignment and provides means of correction for each face should inaccuracy occur.

## SIZES.

24 Inch and 36 Inch "Rapid Production Type."  
36 Inch and 42 Inch "New Era Type."

## THE KING MACHINE TOOL CO.

CINCINNATI, OHIO

30" AND 34" VERTICAL TURRET MACHINES.  
VERTICAL BORING AND TURNING MACHINES—40" TO 84" INCLUSIVE

Having been designed after high-speed tool steels had fully demonstrated their possibilities, these machines are constructed to tax the best of them to their limit and have sufficient weight to not only withstand the strains imposed, but also to absorb the shock and vibration incident to machining under modern shop conditions.

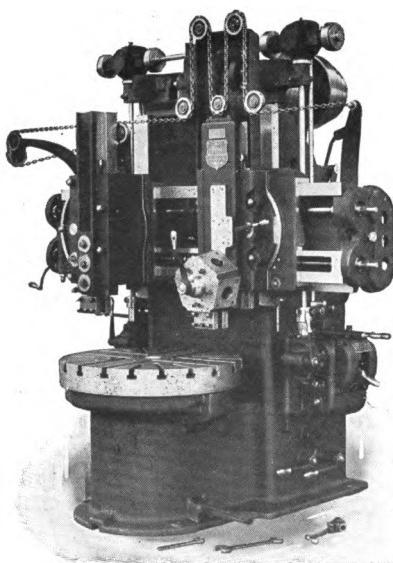
Every feature which has demonstrated its worth in modern boring-mill practice has been incorporated in the design of each machine, from smallest to largest, while no attachments have been added solely to serve as talking points and, consequently, these mills are free from needless complications and trappiness. The material entering into their construction is everywhere the best for the particular service demanded of that part, the workmanship is of the highest grade, all parts are made as nearly interchangeable as is practicable in machines of this size and excessive finish has been eliminated.

Care has been exercised to render all parts easy of access, easy to lubricate and easy to adjust; operating levers are so grouped as to require the minimum expenditure of effort on the part of the operator; gearing is fully protected by guards, the latter being hinged to swing aside at those points where access to gears is desirable. Motor-drive application was fully considered in making the original design and all sizes of machines are adapted to the use of any make of motor, either constant or variable speed—the latter having a maximum ratio of 2 to 1.

Original alignments are extremely accurate and provision is made for maintaining them. All sizes are entirely self-contained and should be placed upon solid, unyielding foundations in order to secure best results and most quiet operation.

### IMPORTANT FEATURES.

Power rapid traverse to heads in all directions, with table either at rest or in motion



Instantaneous feed-changing mechanism, whereby any feed may be obtained at will.

Single-lever control, whereby the rapid traverse may be engaged in any direction by one lever, independently of positive feeds.

Resilient drive which eliminates chatter and gear marks.

Mechanical belt shifter, operated by a single lever.

Adapted to motor drive of any style or make.

Foot-brake to table of larger machines.

Safety device to guard against overloading of feed mechanism.

Friction rail-elevating mechanism, noiseless in operation and overcoming objectionable features of tumbler-gears at this point.

Automatic and adjustable knock-out to all feeds, positive in action and working within extremely close limits.

## THE KING MACHINE TOOL CO.

### GENERAL DESCRIPTION

Wearing surfaces and bearings are of such proportions as to insure durability and to withstand the most severe service to which machines of their size and capacity should be subjected. All plane surfaces are scraped to surface-plates and cylindrical bearings are ground. All driving shafts, feed shafts and cross-rail screws are made from high carbon, open hearth steel; screws are carefully chased in special machines and worms are milled. Spur- and bevel-gear pinions are of steel, spur gears are cut from the solid and bevel gears are correctly planed. All screws and nuts, except those not likely to require adjustment, are hardened.

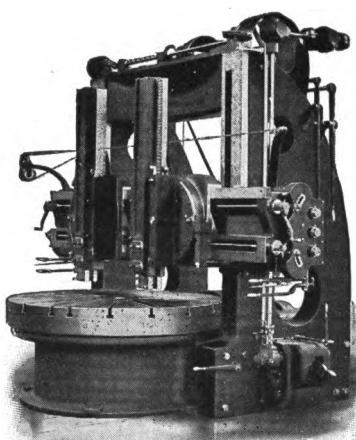
To eliminate the use of separate countershafts the upper cone pulley shaft is provided with tight-and-loose pulleys and is mounted on top of the machine; this arrangement gives all the advantages of the single-pulley drive, yet allows the use of efficient cone pulleys which, in connection with the mechanical belt-shifter, give rapidity of speed change equalled only by controller of a variable-speed motor. All machines are provided with four mechanical changes of table speed, two through friction clutches and two through positive clutches, and these, in conjunction with the changes obtainable through the cone pulleys, furnish from twelve to twenty table speeds, depending on the size of the machine.

Motor drives, employing either constant or variable speed motors, are easily arranged. If a constant speed motor is used it is belted to the upper cone-pulley or driving shaft, located on the top of machine, and the speed variations are obtained through the cone pulleys and the four mechanical speed changes of driving-head. If a variable-speed motor is employed, the cone pulleys and belt-shifter are dispensed with and the two to one speed-range of the former is obtained through the motor.

All machines are equipped with power rapid traverse to heads in all directions and also with what is termed a "rail-box," the office of which is to furnish change from vertical to horizontal movement, or vice versa, of the head which it controls by the manipulation of a lever and without the use of slip-gears at ends of rail. It also provides a safety point in the feed train and may be equipped with attachment for screw-and scroll-cutting.

The cross-rail is of the narrow-guide type and the heads are square-locked, machined from the solid without loose clamps and provided with taper gibbs which are adjustable to compensate for wear. The tool-bars are provided with steel rack their entire length; they carry forged tool-posts and may be swiveled to either side of the vertical by worm-and-segment device.

The table is provided, on its under side, with a conical seat which rests upon a similar bearing on the spindle. This has a self centering tendency, reduces side-thrust on the spindle and is of such proportions that the maximum load borne is well within the limits prescribed for such service.

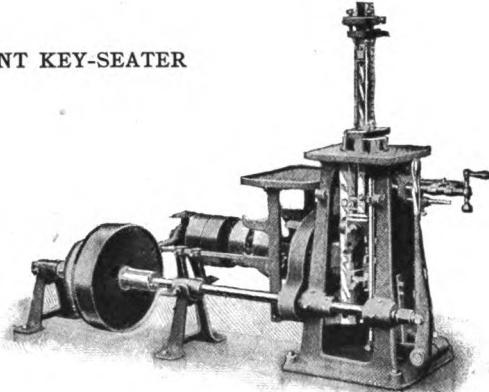


## Key-Seating Machines

# MITTS & MERRILL

SAGINAW, MICHIGAN  
THE GIANT KEY-SEATER, KEY-SEAT MILLING MACHINES,  
A BORING MILL

THE GIANT KEY-SEATER



No. 2 Giant Key-Seater and Countershaft.

*THE GIANT KEY-SEATER* cuts perfectly true. Key-ways straight or tapered without regard to whether the hub is faced true or left rough as it comes from the foundry. Every job is quickly and accurately set and fastened by its bore only.

This means that in many cases it is possible to save the expense of facing a hub by using the Giant Key-Seater. The saving in money represented by this feature alone will soon pay for the machine.

A key-seat 6" long,  $\frac{1}{2}$ " wide, and  $\frac{1}{4}$ " deep can be cut in two minutes. This includes time of putting on and taking from machine.

The machines may be fitted to cut Key-seats in holes from  $\frac{1}{2}$  inch in diameter up to the largest size needed, and it is possible for the largest machine to operate in very small and long holes. In key-seating small work such as steel milling cutters  $\frac{1}{2}$  inch thick, eighteen or more pieces can be cut at one time. No other machine does this.

We can furnish cutters for special work, such as square holes, half-round key-seats, dovetail key-seats, double key-seats, or other special shapes such as are used in automobile work.

The Giant will finish two ordinary key-seats before one piece can be fastened, ready for key-seating on other styles of machines.

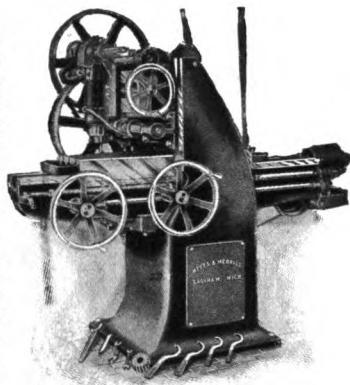
### FLOOR SPACE, WEIGHT AND OTHER DATA

Key-seater	Stroke	Largest Post that may be used	Widest Cutter that may be used	Approx. Gross Weight	Floor Space
No. 0	7 inch	$1\frac{1}{2}$ inch	$\frac{3}{4}$ inch	650 lbs.	$2 \times 3$ ft.
No. 2	13 inch	$2\frac{3}{8}$ inch	$1\frac{1}{4}$ inch	1500 lbs.	$5 \times 2$ ft.
No. 3	16 inch	$3\frac{3}{8}$ inch	2 inch	1900 lbs.	$5\frac{1}{2} \times 2$ ft.
No. 3A	25 inch	$3\frac{3}{8}$ inch	2 inch	2000 lbs.	$5\frac{1}{2} \times 2$ ft.
No. 4	19 inch	$3\frac{1}{4}$ inch	$2\frac{1}{2}$ inch	2100 lbs.	6 $\times 2$ ft.
No. 5	25 inch	$4\frac{1}{8}$ inch	3 inch	4300 lbs.	$6\frac{1}{2} \times 3$ ft.
No. 6	31 inch	6 inch	4 inch	4800 lbs.	$6\frac{1}{2} \times 3$ ft.
No. 6A	38 inch	6 inch	4 inch	4800 lbs.	$6\frac{1}{2} \times 3$ ft.

**MITTS & MERRILL**  
SAGINAW, MICH.

**KEY-SEAT MILLING MACHINE**

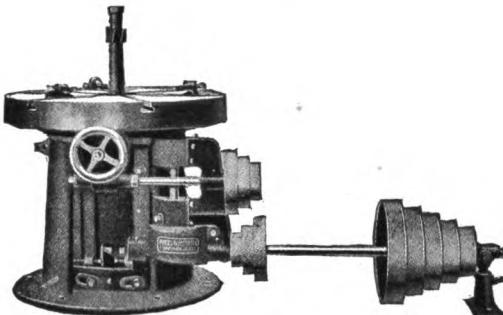
Our No. 3 Key-Seat Milling Machine is equipped with a vertical arbor for routing out the ends of key-seats. The machine is strongly geared and stiffly built for key-seating shafts up to 10" in diameter, and for ordinary plain milling up to capacity of the machine. The hand wheels for the different feeds and movements of the machine are conveniently arranged and the weight of the crossrail and gearing is counterbalanced. The platen has basins on each end to catch the lubricant for which the rail serves as a reservoir. The vertical and cross feed have micrometers for fine adjustment. With the machine is furnished wrenches and an adjustable floor stand for shafting. Two smaller sizes are made as listed below. The No. 1 machine is only suitable for milling key-seats in shafting. Nos. 2 and 3 will do for plain milling also.



No. 3 Key-Seat Milling Machine  
For 1 inch to 10 inch shafts.

Machine	Capacity	Table	Traverse	Floor Space Req.	Weight
No. 1	¾ in. to 3 in. dia. shaft	12 long	14	34 x 22	800 lbs.
No. 2	1 in. to 6 in. dia. shaft	26 x 12	34	36" x 31 or 40	2800 lbs.
No. 3	1 in. to 10 in. dia. shaft	44 x 12½	43	74 x 36	4100 lbs.

**BORING MILL**



For Straight or Taper Holes up to 8 in. Diameter

We illustrate a Boring Mill which we manufacture and have used in our own shop for several years. It is designed for boring a class of duplicate or heavy work difficult to chuck in a lathe, and for the occasional job of large diameter. Driving shaft and pulley can be extended any distance required to swing the work on revolving table. Cutter bar is clamped in a saddle sliding on a vertical rail which is pivoted at the top and can be swung from the perpendicular to bore holes up to 2 inch taper per foot or more if required.

*Capacity:* will bore holes up to 8 inches diameter and 18 inches long.

*Table:* 35 inches diameter, 5 inches deep; has 6 T slots for  $\frac{3}{8}$  inch bolts. Height of table above floor, 33 inches. Bearing for table is a  $7\frac{1}{2} \times 45^\circ$  V bearing 3 inches wide, 18 inches diameter.

*Vertical rail,* 2 feet 9 inches long, 10 inches wide.

*Saddle* has bearing 14 inches long and a travel of 18 inches. Saddle holds boring bars up to  $2\frac{1}{4}$  inches diameter.

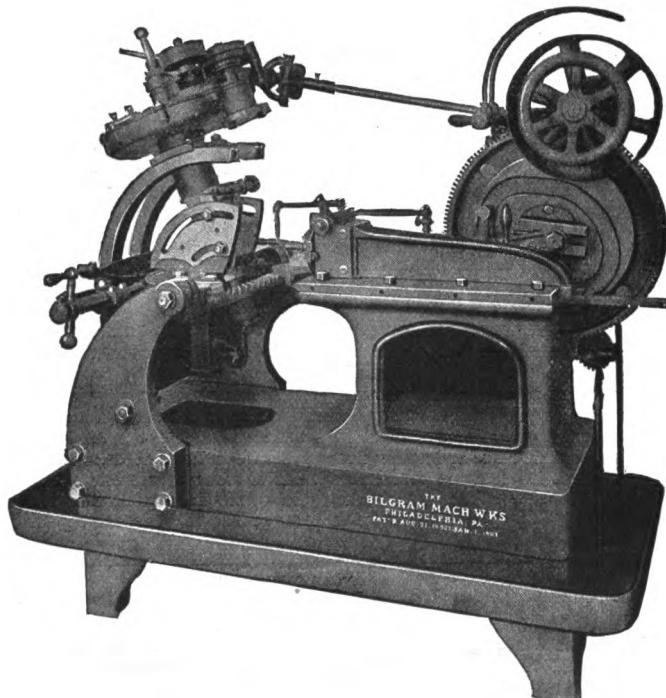
*Floor space,* 3 feet 6 inches by 6 feet 6 inches. Weight 2300 lbs.

## *Bevel Gear Generators*

# THE BILGRAM MACHINE WORKS

1217 SPRING GARDEN ST. PHILADELPHIA, PA.

MAKERS OF SPECIAL MACHINERY  
BEVEL GEARS CUT THEORETICALLY CORRECT  
SPECIAL FACILITIES FOR CUTTING SPUR, WORM, SPIRAL AND  
INTERNAL GEAR WHEELS



### THE BILGRAM BEVEL GEAR GENERATOR SIX INCH TYPE

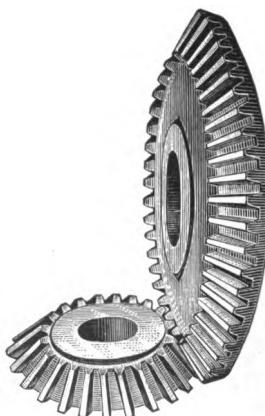
Planes bevel wheels up to 6 in. diameter, 1 in. pitch,  $2\frac{1}{2}$  face, from miter wheels to bevel wheels of proportion one to six.

Floor Space ..... 3 ft. 10 in. x 2 ft. 3 in.  
Net weight of machine ..... 2000 lbs.  
Net weight of countershaft, cone sectors,  
etc. ..... 400 lbs.  
Gross weight ..... 2800 lbs.

### SIXTEEN INCH TYPE

Planes bevel wheels up to 16 in. diameter, 2 in. pitch, 6 in. face from miter wheels to bevel wheels of proportion one to four.

Floor space ..... 6 ft. 1 in. x 2 ft. 8 in.  
Net weight of machine ..... 4800 lbs.  
Net weight of machine, countershaft, cone  
sectors, etc. ..... 800 lbs.  
Gross weight ..... 6100 lbs.



**THE WHITMAN & BARNES MFG. CO.**  
GENERAL OFFICES, AKRON, OHIO

MANUFACTURERS OF  
**TWIST DRILLS, REAMERS, DROP FORGED AND SCREW WRENCHES, SPRING  
COTTERS, FLAT SPRING AND RIVETED KEYS.**

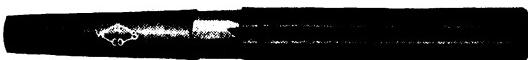
Factories:           AKRON, OHIO           CHICAGO, ILL.           ST. CATHARINES, ONT.



**"HERCULES" AND "DIAMOND" HIGH SPEED DRILLS**

Our catalog B-82 presents a complete line of twist drills adapted to all requirements. These are manufactured in CARBON AND VANADIUM HIGH SPEED STEEL.

It is now an acknowledged fact that HIGH SPEED drills, even after taking into account the high first cost as compared with carbon drills, are more economical in four out of five classes of work.



**CARBON AND "DIAMOND" HIGH SPEED REAMERS**

"W. & B." REAMERS comprise all styles and sizes and are manufactured in both CARBON and DIAMOND HIGH SPEED STEEL. They have been developed to high efficiency by the careful manufacturing methods applied to all "W. & B." products.

SPECIAL REAMERS made to order in Carbon or High Speed Steel.



**RAILROAD SPECIAL WRENCH**

This is the strongest and best HEAVY DUTY wrench made. Head and Bar Drop-Forged in one piece from selected steel. Extra heavy jaws thoroughly case-hardened. Indestructible iron handle. Easy acting screw. Every wrench guaranteed against defective material and workmanship.

Sizes—6, 8, 10, 12, 15, 18 and 21 inches.



**MACHINISTS' KNIFE HANDLE WRENCH**

This is practically the same as the Railroad Special Wrench except for the difference in the handle.

Made in the same sizes and with the same superior material and workmanship.



**DROP FORGED WRENCHES**

We manufacture at our Chicago Factory a complete line of drop-forged wrenches. The successive steps using the correct metal, heating, forging, milling, finishing and inspecting are so carefully carried out that W. & B. Diamond Trademarked Wrenches have become the standard for superior strength and service.

CATALOG B-82 ON REQUEST.

## Screw Cutting Dies

# IDEAL OPENING DIE COMPANY

BEAVER FALLS, PA.

MANUFACTURERS OF SCREW CUTTING DIES

### THE IDEAL OPENING DIE

*Opens by power of cutting strain:* The cutting strain in all opening dies has a tendency to revolve the head holding chasers and not the cam. It is obvious therefore that by allowing the head of our die to revolve, we convert the cutting strain into an opening power instead of depending on springs.

*Head revolves instead of cam:* The superiority of this construction over dies which depend on the life and variation of a spring for their successful operation, will be apparent to every mechanic. Spring actuated devices are notably unreliable, and apt to be out of order when most needed.

*Faulty alignment overcome:* We have designed in our die an equalizing driving clutch which compensates for any imperfection in alignment of either the turret or the material being threaded.

*Chasers supported:* The support for chasers in the Ideal Die puts an end to the tipping evil. They are supported by a hardened cam directly over and slightly preceding the point of strain. This chaser support together with the equalizing driving clutch, eliminates taper threads and bad work generally.

*Four chasers instead of three:* The advantage of four chasers over three is obvious. With four chasers you have the cutting points opposite, while with three chasers, as soon as one chaser becomes dull, it crowds the metal between the other two, thereby producing work that is not round.

*Half as many parts:* The Ideal Die has few parts and is easy to take apart and assemble.

*Detachable Shank:* The detachable shank makes it possible to use the same die in different sized machines.

*Left and Right Hand Threads:* The same die will cut either left or right hand threads; the former by simply changing index from right hand to left hand, and using left hand chasers.



Size.....	1/4 inch	5/16 inch	3/4 inch	1 inch	1 1/4 inch
Diameter of head.....	1 1/8 in.	2 1/4 in.	2 1/2 in.	3 1/8 in.	4 1/4 in.
Length of head.....	1 1/8 in.	1 1/8 in.	2 1/2 in.	2 3/4 in.	3 1/2 in.
Diameter of shank.....	5/8 or 3/4 in.	7/8 or 1 1/8 in.	1 1/4 or 1 1/2 in.	1 1/2 or 1 3/4 in.	1 3/4 or 2 1/4 in.
Length of shank.....	2 in.	2 1/2 in.	3 in.	4 in.	4 1/4 in.
Length over all.....	3 5/8 in.	4 1/8 in.	5 1/4 in.	6 1/4 in.	7 1/4 in.
Capacity.....	1/2 to 1 1/4 in.	1 to 1 1/2 in.	1/4 to 3/4 in.	5/8 to 1 in.	1/2 to 1 1/4 in.
Chasers in set.....	4	4	4	4	4
With 1 set of chasers....	\$25.00	\$30.00	\$40.00	\$50.00	\$65.00
Extra shanks, each....	4.00	5.00	6.00	7.00	8.00
Standard chasers per set.....	1.25	1.50	2.00	2.50	3.00
Special chasers per set.....	2.00	2.50	3.00	3.50	4.00
H. S. Steel Extra .....	1.00	1.00	1.00	1.00	1.00

One set of Standard pitch chasers, either U. S. V. or Whitworth, right or left hand furnished with die.

For sizes desired not listed in table above send specifications.

# MODERN TOOL COMPANY

ERIE, PA., U. S. A.

**SELF-OPENING DIE HEADS, ADJUSTABLE SOLID DIES, TAP AND DIE HOLDERS  
CHASER GRINDERS, FRICTION AND POSITIVE DRIVE MAGIC CHUCKS  
TAPPING ATTACHMENTS AND MODERN GRINDING MACHINES  
MAKERS OF SPECIAL TOOLS AND FIXTURES**

### "MODERN" SELF OPENING DIES

The advantages of the "Modern" Die are many. The Die opens automatically when the thread is cut. No reversing of the machine. The return is  $2\frac{1}{2}$  to 1. No danger of injuring either the thread or Die. 50% to 80% in time and wear to belts and countershaft is saved. The



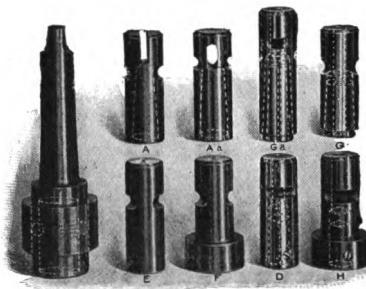
*"Modern" Self Opening Die*

"Modern" is the one Die having a steel cam to hold Chasers in place directly over point of duty, making it impossible for Chasers to bell at the mouth and preventing irregular or taper thread. When a large amount of stock is to be removed or precision required, a roughing and finishing attachment will be furnished.

"Modern" Chasers are all cut on a hob and are made either of carbon or high speed steel.

### "MAGIC" CHUCK EQUIPMENT

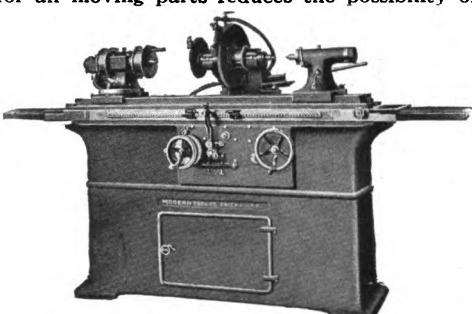
For the rapid changing of tools in drill press, lathe, screw machine, etc., without stopping the machine, practically converting a single spindle machine into a multiple spindle one, with as many tools as you may have operations. Try it and save labor cost.



*"Magic" Chuck and Collets*

### "MODERN" GRINDING MACHINES

Much unnecessary weight is eliminated and perfect rigidity and freedom from vibration secured by the scientific distribution of material in "Modern" Grinding Machines. Generous bearings for all moving parts reduces the possibility of wearing and prevents absolutely all chatter. Centralization of working parts secures perfect transmission of power to the working point. Accessibility of the working parts for care and attention by the operator makes minimum loss of use, cost of up-keep and depreciation. Improved operative features insure large production and precision work.



*"Modern" Grinding Machine*

**ALL "MODERN" TOOLS GUARANTEED TO BE SATISFACTORY  
TO THE USER**

Complete information concerning products will be mailed interested parties upon request.

# THE CURTIS & CURTIS COMPANY

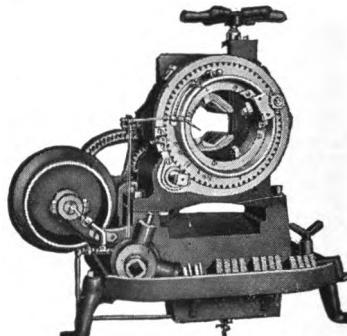
93 Garden Street,

BRIDGEPORT, CONNECTICUT

PIPE CUTTING AND THREADING MACHINERY



Hand Machine



Power Machine

## THE FORBES PATENT PIPE CUTTING AND THREADING MACHINE

In presenting this machine we would ask your attention to the following points:  
It will save you its entire cost in a short time, in time and hard labor saved.  
Our Pipe Machine is a complete tool, being all that is required to thread or cut off pipe.

It is much lighter than the old style of stock and the vise which must accompany it.

It is less expensive than the above combination.

It can be used in confined places.

It is particularly adapted to trench work.

Its dies can be sharpened by grinding without first drawing temper.

They draw back out of the way when the thread is cut, yet always cut standard sizes, and are adjustable to any variation of the fittings.

The shell can be adjusted to take up wear of gear.

Its dies are less expensive than solid dies, and last much longer.

Any one die of a set can be replaced when lost or worn out without replacing the entire set.

Its parts are interchangeable and can be duplicated when worn out, at a small cost.

### MOTOR DRIVEN TYPE

This machine is equipped with a specially designed Die head which does away with all thumb screws for adjusting the dies, which are now clamped with one movement of a lever; it has self-centering vise.

*BASE.* Mounted on cabinet base with a motor for any current desired concealed within, and direct connected through triple compound cut spur gears on machine.

*STRAINER.* In center of the pan is located a strainer to separate the oil from the chips. It is thus drained, and can be used over again until unfit for use.

*PUMP.* Driven by gears. It is out of the way of the operator, and direct connected. No belts to annoy you.

*GEARS.* All are machine cut and entirely protected from chips or accidents.

*MOTOR.* Any current desired concealed in cabinet base, thus protected from oil or dirt, or breakage resulting from handling of long and heavy lengths of pipe and fittings.

*Complete Catalog on Request*



Motor Driven Machine

## WM. SHELTON NICHOLLS

251 Broadway  
NEW YORK, N. Y.

16 Church Street  
HOOSICK FALLS, N. Y.

TOOLS, MACHINERY, MACHINE SHOP EQUIPMENT

## HERCULES PORTABLE CRANE HOIST

Patented Dec. 13, 1905

There are many firms whose work does not warrant installing an extensive system of overhead travelling cranes, but is nevertheless too heavy to handle by primitive methods.

There are other firms who already have overhead trolleys, travelling cranes, etc., which do not meet all the requirements of the plant. They are limited in scope to the length of the runways.

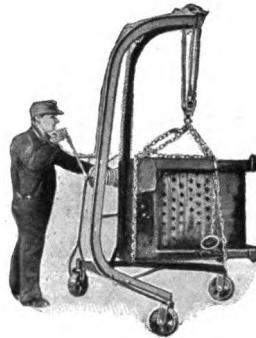
In both instances, there is a real need for our *Hercules Portable Crane and Hoist*.

This is a compact movable machine, with wheels on roller bearings. Operated by one man it will pick up a heavy casting, a shaper, or even a lathe, and move it to any point on the shop floor, or from one building to another.

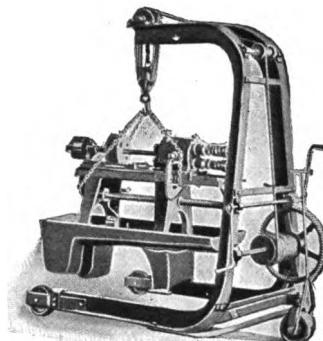
Its design is such that it can be used in many ways, and for countless purposes, and it is made in a variety of sizes to suit all requirements and pocketbooks. It is always ready, easily put aside when the work is done, and when not in use can be put in an out-of-the-way corner of the shop.

Of constant use in machine shop tending planers and lathes, etc.

The frame is of structural steel shapes, giving wonderful strength and reliability.



No. 1, Weight 285 lbs.  
Capacity 1000 lbs.  
Standard Pattern



No. 6-B. Wt. 1250 lbs. Capacity 6000  
lbs. Low down Pattern

## DIMENSIONS, WEIGHTS, AND CAPACITIES OF STANDARD SIZES

Size	Weight, Lbs.	Capacity, Lbs.	Height over all	Width over all	Length over all	Over- hang	Hoist	Price
1	285	1000	8 ft.	4 ft. 2 in.	4 ft.	1 ft. 11 in.	6 ft. 9 in.	\$45.00
2	325	2000	8 ft.	4 ft. 2 in.	4 ft.	1 ft. 11 in.	6 ft. 9 in.	57.50
3	425	3000	8 ft.	4 ft. 2 in.	4 ft.	1 ft. 11 in.	6 ft. 9 in.	70.00
4	850	4000	9 ft.	4 ft. 8 in.	4 ft. 11 in.	2 ft. 6 in.	7 ft. 2 in.	90.00
5	940	5000	9 ft.	4 ft. 11 in.	5 ft.	2 ft. 9 in.	7 ft. 2 in.	105.00
6	1050	6000	9 ft.	5 ft. 2 in.	5 ft. 4 in.	2 ft. 9 in.	6 ft. 8 in.	125.00
6-B*	1250	6000	8 ft.	4 ft. 9 in.	6 ft. 10 in.	3 ft. 4 in.	5 ft. 8 in.	150.00

\* Low down pattern.

Write for Catalog

**E. W. BLISS CO.**

BROOKLYN, N. Y.

**LARGEST BUILDERS OF  
SHEET METAL WORKING MACHINERY**

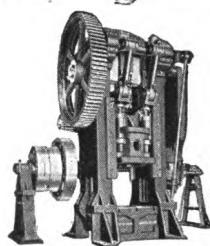
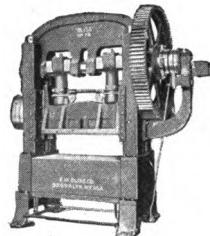
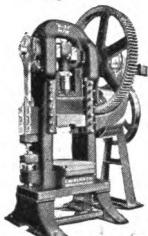
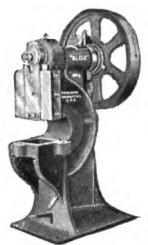
The most complete line of machines for sheet metal working in the world.

Presses for every ordinary kind of work and special machines for unusual requirements. Drop Forging machinery, Hinge and Butt machinery, Fork and Spoon machinery, Expanded Metal Lath machinery, Shovel machinery, Horse Shoe machinery, Minting machinery, Automobile Parts machinery, Spinning Lathes, Gang Slitters, Circle Shears, Perforating, Punching, Slitting, Shearing, Beading, Flanging, Crimping and Seaming machines.

Complete equipments for the economical manufacture of Petroleum and Alcohol Cans, Fruit and Vegetable Cans, (Sanitary and Packers'), Meat Cans, Paint and Varnish Cans, Lard Pails and Butter Tins, and all kinds of Tin Cannisters, Boxes and Packages.

Machinery for manufacturing Soft Metal Tubes, Tinware, Enamelware, Aluminum, and Silverware, Metal Shingles, Metal Ceilings, Sheet Metal Furniture, Kitchen Utensils, Kitchen Boilers, Oil Stoves, Lamps, etc., etc.

We are also equipped for die work of every description.



Catalogues describing any of our lines will be sent on request

- |  |   |
|--|---|
| No. 1. "Bliss" Inclinable Power Presses.                       | No. 10. "Bliss" Machinery for Manufacturing Pieced Tinware.   |
| No. 2. "Stiles" Power Punching Presses.                        | No. 11. "Bliss" Minting Machinery.                            |
| No. 3. "Bliss" Straight-Side Power Presses.                    | No. 12. "Bliss" Machinery for Manufacturing Electrical Parts. |
| No. 4. "Bliss" Drop Hammers and Trimming Presses.              | No. 13. "Bliss" Drop Forging Machinery.                       |
| No. 5. "Bliss" Toggle Drawing Presses and Spinning Lathes.     | No. 14. "Bliss" High Speed Automatic Can Making Machinery.    |
| No. 6. "Bliss" Foot and Screw Presses.                         | No. 15. "Bliss" Railway Motor Gears and Pinions.              |
| No. 8. "Bliss" Double Crank Presses.                           | No. 16. "Bliss" Machinery for Manufacturing Automobile Parts. |
| No. 9. "Bliss" Machinery for Manufacturing Tin Cans (Spanish). |   |

# NIAGARA MACHINE & TOOL WORKS

BUFFALO, N. Y., U. S. A.

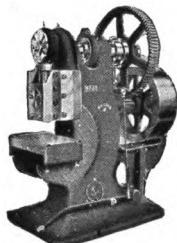
TOOLS AND MACHINES FOR SHEET METALS, PRESSES AND PUNCHES,  
POWER SHEARS, TINSMITHS' TOOLS, FORMING ROLLS, DIES, ETC.

Our line of tools and machines for working sheet metals is very extensive, the machines here illustrated comprising only a few representative types. We use nothing but the best of materials, and the castings are made in our own foundry. Superior facilities and a force of expert workmen enable us to produce work of the highest class.

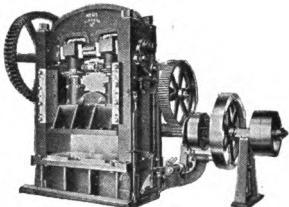
Our products are presented on their merits and we solicit an examination of their efficiency and durability.



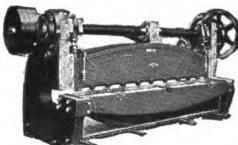
No. 6 Niagara Inclinable Power Press



No. 38 Niagara Geared Power Punching Press



No. 615 Niagara Power Press Double Crank Type



Niagara Power Squaring Shear  
No. 9126

## INCLINABLE PRESS

These presses are unsurpassed in workmanship, convenience, and durability, and the range of work for which they are suited is almost unlimited, including blank cutting, punching, forming, and combination dies. The wearing surfaces are large and all parts well fitted.

9 sizes ranging from 500 to 7300 lbs. weight.

## PUNCHING PRESS

These presses are adapted to heavy work, the design combining strength and compactness with convenience in handling the work. They are especially suitable for punching and cutting bars and heavy sheet metal; for operating cutting and forming dies required in the manufacture of hardware, cutlery, etc.

Five sizes geared.

Five sizes not geared.

## DOUBLE CRANK PRESS

This press is intended for operating dies covering a large area and where great power is required. The speed is so regulated that in some cases the operators can remove and feed the sheets between two strokes without stopping the motion of the slide.

Will take work up to 13 x 56½ inch area.

## POWER SQUARING SHEARS

This illustration shows one of our largest shears capable of shearing  $\frac{1}{4}$ -inch sheet steel, with a cutting length of 126 inches and a gap of 18 inches.

We make many smaller styles and sizes down to the No. 10 series intended for No. 22 iron and lighter.

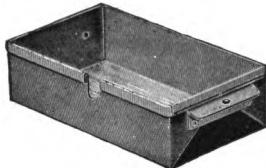
*Complete Catalog on Request.*

# THE CLEVELAND WIRE SPRING CO.

CLEVELAND, OHIO, U. S. A.

WIRE SPRINGS, STEEL BOXES, STEEL SHOP RACKS, STEEL WASTE CANS, STEEL STOOLS, BRICK AND MORTAR HODS, BARREL TRUCKS, ETC.

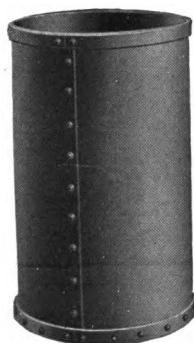
## IRON CLAD TRIPLE HEM STEEL SHOP BOXES



Patented

Our Iron Clad Steel Shop Boxes are made with a continuous triple hem of the metal around the top edge and corners. This adds strength and stiffness to the box and at the same time reinforces the corners, preventing their tearing down at that point. This tearing down is a common fault in other makes.

These boxes are made from one piece of sheet steel and are provided with strong handles. Also with holes for the insertion of a hook for dragging the boxes. Made in a great variety of styles, and to meet any special requirement.



Patented

## STEEL SHOP AND FOUNDRY BARRELS

Triple Hem Steel Barrels are made with a heavy triple reinforcing band or hoop around the top and bottom. The band and body are of one piece producing not only stiffness and rigidity but also smooth edges that will not cut the hands or floor and doing away with loosely riveted hoops. The bottom is a solid flanged steel head, strongly riveted to shell.

Furnished in Galvanized Iron with Soldered joints or galvanized after made when desired.

## OTHER STEEL SPECIALTIES

Steel Shelving  
Steel Barrel Trucks  
Shelf Tool Racks  
Machine Tool Racks  
Care Trays for Foundries

Lathe Pans  
All Steel Shop Stools  
Heavy Steel Trays  
Oily Waste and Rubbish Cans  
Washing Kettles



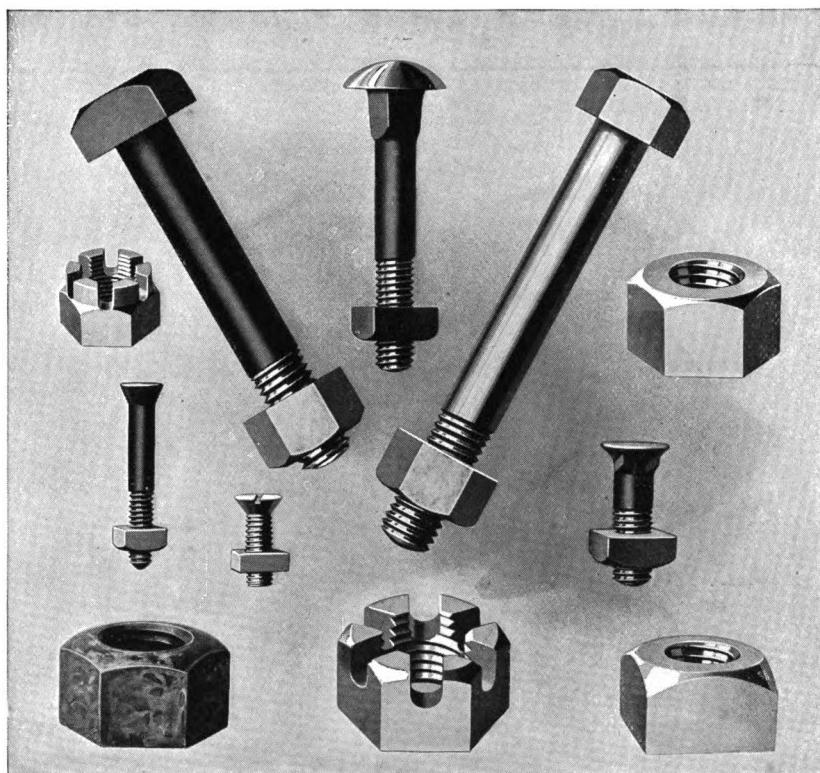
SPRINGS—Coiled and Flat—all styles  
WIRE, formed to desired shapes for manufacturing purposes

# RUSSELL, BURDSALL AND WARD BOLT AND NUT COMPANY

PORT CHESTER, N. Y.

ROCK FALLS, ILL.

## BOLTS AND NUTS



### Manufacturers of

#### All kinds of

Carriage Bolts  
Machine Bolts  
Coupling Bolts  
Stud Bolts  
Tap Bolts  
Plow and Cultivator  
Bolts

Stove Bolts  
Tire Bolts  
Rivets and Special Bolts  
of all descriptions  
Cold Punched, Chamfered  
and Trimmed Hexagon  
and Square Nuts

A.L.A.M. Plain and Cas-  
tellated Nuts  
Master Mechanics' Cas-  
tle Nuts  
Semi-finished, Full Fin-  
ished and Case Hard-  
ened Nuts

### Our Trade Mark:

"EMPIRE"

signifies a certain standard of excellence that invites your investigation.

## RHODE ISLAND TOOL COMPANY

PROVIDENCE, RHODE ISLAND

Established 1834

COLD PUNCHED, CHAMFERED, TRIMMED AND DRILLED SQUARE AND HEXAGON NUTS; SEMI-FINISHED, (TAPPED AND FACED) NUTS; FINISHED CASE HARDENED NUTS; CASTLE NUTS; MACHINE BOLTS; TAP BOLTS, ROUGH AND MILLED; COUPLING BOLTS; CAP AND SET SCREWS; LARGE HEAD CAP SCREWS; STUDS, ROUGH AND MILLED; CHAIN LINKS; WASHERS; PRESS WORK; FORGINGS; EYE BOLTS; TURN BUCKLES; WRENCHES; SCREW MACHINE PRODUCTS.

---

We are particularly fitted to furnish Screw Machine Work and Special Bolts and Nuts.

Chamfered, Trimmed, and Drilled Nuts are made by cold punching special material and have smoothly trimmed sides.



They are made Square and Hexagon and can be furnished tapped, if desired.

Semi-Finished Nuts are the same as the above, tapped and faced with washer finish on the bottom.



Finished and Case Hardened Nuts are finished all over with round top and then case hardened, giving a mottled effect.

Castle Nuts are semi-finished with three slots across the top for cotter pins.



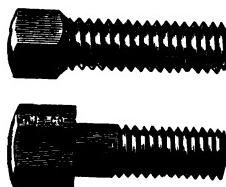
## RHODE ISLAND TOOL COMPANY

Machine Bolts are furnished with Square or Hexagon Heads and Square or Hexagon Nuts. Interchangeability is an important factor and this is guaranteed on all bolts.



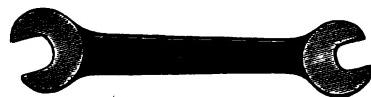
Studs are made Rough or Milled. The material from which these are made is especially adapted for this work and was obtained after exhaustive tests. It is uniform in quality and its physical properties give it the strength and toughness which are so essential in this class of material.

Set Screws and Cap Screws are made of special screw stock and particular attention is given to finish. Round or Cup Point Set Screws and Hexagon Head Cap Screws are carried in stock in large quantities.



Large Head Cap Screws are also carried in stock. These screws have a head which is United States Standard in size giving a greater bearing surface. This size of head also fits a Standard Wrench.

Machinists' Wrenches, Single, Double End and Set Screw are furnished with milled openings, semi-finished or finished and case hardened. The Semi-Finished Wrench is made with milled openings and case hardened with the heads polished. Special Wrenches can be made to advantage if blueprints are submitted.



Drop Forgings are made to samples or prints and prices will be quoted upon request.

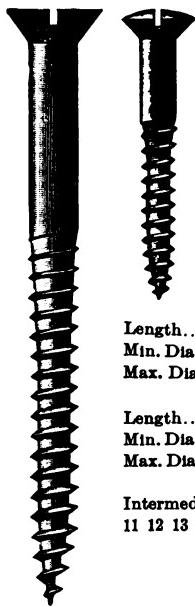
All of the above articles are fully set forth in catalogue showing lists and complete line of products and will be mailed to any one interested.

# AMERICAN SCREW COMPANY

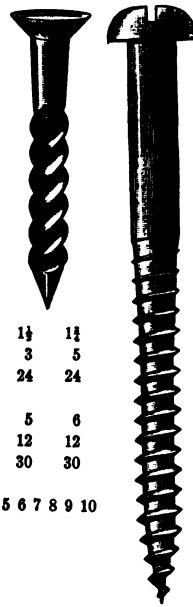
PROVIDENCE, R. I.

MAKERS OF WOOD SCREWS, MACHINE SCREWS, STOVE BOLTS, TIRE BOLTS, RIVETS, ETC.

Flat Head Oval Head



Drive Screw Round Head



## WOOD SCREWS

Flat and Round Head Wood Screws are regularly made in Iron in the following sizes, and in Brass in sizes of approximately the same variety; other kinds of Wood Screws are made in the sizes commonly used.

Length.....	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{2}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{4}$
Min. Dia....	0	0	1	1	2	2	3	3	3	5
Max. Dia....	4	9	12	14	16	16	20	24	24	24

Length.....	2	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	6
Min. Dia....	5	5	5	6	6	8	8	12	12	12
Max. Dia....	24	24	24	24	26	26	30	30	30	30

Intermediate diameters advance as follows: No. 0 1 2 3 4 5 6 7 8 9 10  
11 12 13 14 15 16 17 18 20 22 24 26 28 30

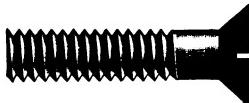
## MACHINE SCREWS

Flat, Round, and Fillister Head Machine Screws are regularly made in Iron in the following sizes, and in Brass in sizes of approximately the same variety:

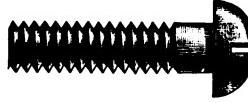
Length.....	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{4}$
Min. Dia....	2	2	2	2	2	2	2	2	3	4	4	4
Max. Dia....	10	14	16	24	24	24	24	26	34	34	34	34
Length.....	$1\frac{1}{8}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	3	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	4	$4\frac{1}{2}$	$4\frac{1}{2}$	5
Min. Dia....	6	6	8	8	8	10	10	12	12	12	14	14
Max. Dia....	34	34	34	34	30	30	30	30	30	30	30	30

Intermediate diameters advance as follows: No. 2 3 4 5 6 7 8 9 10 12 14 16 18 20 22 24 26 28 30 34

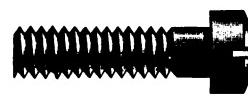
Flat Head



Round Head



Fillister Head



Diameter No.	2	3	4.5	6	7	8	9.10	12	14
Threads per in.	48.56.64	48.56	32.36.40	30.32.36	30.32	30.32.36	24.30.32	20.24	18.20.24
	16.18	20.22	24	26.28.30	34				
	16.18.20	16.18	14.16.18	14.16	13				

Regular Side Knob Screws are  $\frac{1}{4}$  inch No. 9, 24 thread.

See also next page.

## AMERICAN SCREW COMPANY

## STOVE BOLTS



Flat and Round Head Iron Stove Bolts are regularly made in the following sizes:

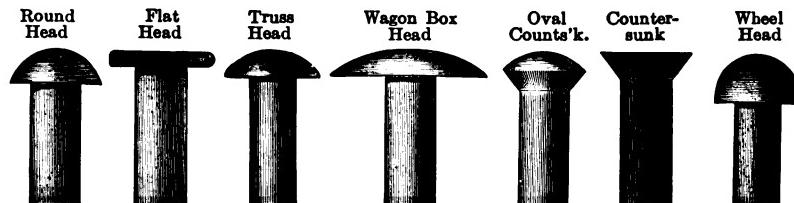
Diameter.....	$\frac{1}{8}$	$\frac{5}{32}$	$\frac{7}{32}$	$\frac{9}{32}$	$\frac{11}{32}$	$\frac{13}{32}$	$\frac{15}{32}$	$\frac{17}{32}$	$\frac{19}{32}$	$\frac{21}{32}$	$\frac{23}{32}$	$\frac{25}{32}$
Min. Length.....	2	2	6 $\frac{1}{2}$	6$\frac{1}{2}$	6$\frac{1}{2}$	6$\frac{1}{2}$	6$\frac{1}{2}$	6$\frac{1}{2}$	6$\frac{1}{2}$	6$\frac{1}{2}$	6$\frac{1}{2}$	1
Max. Length.....												3

The length advances by eighths of an inch from  $\frac{3}{8}$  to  $\frac{1}{2}$ , then by quarters to 6 $\frac{1}{2}$ .

## STOVE RODS

Stove Rods are the same as Stove Bolts in every respect excepting length. They are regularly made in Iron of  $\frac{1}{16}$  and  $\frac{1}{8}$  diameter in length from 7 to 40," advancing by halves of an inch.

## RIVETS



Cold-headed Rivets are made in great variety of styles and sizes up to  $\frac{1}{16}$  in diameter and 6 in length.

## MEASUREMENTS

The length includes the head of Flat Head Screws, Stove Bolts, and Stove Rods; excludes the head of Round and Fillister Head Machine Screws and Round Head Stove Bolts and Stove Rods; includes the countersink of Oval Head Screws and about half the head of Round Head Wood Screws, but the practice with regard to Round Head Wood Screws is not uniform with all makers.

The length of Rivets is exclusive of the head for all styles with a right angle under the head, and inclusive of the countersink for countersunk heads.

The diameter of Screws is measured by the American Screw Gauge, the equivalent in inches being:

0 .0578	5 .1236	10 .1894	15 .2552	22 .3474
1 .0710	6 .1368	11 .2026	16 .2684	24 .3737
2 .0842	7 .1500	12 .2158	17 .2816	26 .4000
3 .0973	8 .1631	13 .2289	18 .2947	28 .4263
4 .1105	9 .1763	14 .2421	20 .3210	30 .4526
				34 .5053

The diameter of Rivets is measured by the Old Standard Birmingham Wire Gauge, the equivalent in inches being:

000 .425	2 .284	6 .203	10 .134	14 .083
00 .380	3 .259	7 .180	11 .120	15 .072
0 .340	4 .238	8 .165	12 .109	16 .065
1 .300	5 .220	9 .148	13 .095	17 .058

See also preceding page.

## *Oil Hole Covers and Cups*

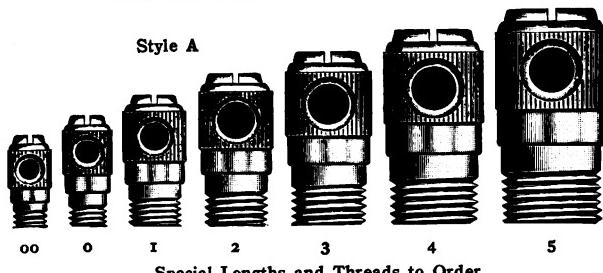
**W. D. & C. F. TUCKER**

HARTFORD, CONN.

LUBRICATING DEVICES

### TUCKER'S TWO-PIECE OIL HOLE COVERS AND CUPS

Style A

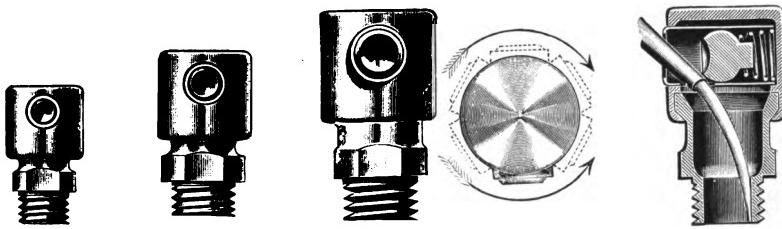


Special Lengths and Threads to Order

	Size of Body	Size of Thread	Diameter of Head	Weight Per 100	Nickel Plated Price Per 100
No. 00.	$\frac{1}{8}$	$\frac{1}{4} \times 40$	$\frac{1}{2}$	$\frac{1}{4}$ lbs.	\$ 7.00
No. 0.	$\frac{3}{16}$	10 x 32	$\frac{1}{4}$	$\frac{1}{2}$ lbs.	7.00
No. 1.	$\frac{1}{4}$	$\frac{1}{4} \times 32$	$\frac{5}{16}$	$\frac{3}{4}$ lbs.	7.00
No. 2.	$\frac{5}{16}$	$\frac{1}{4} \times 32$	$\frac{3}{8}$	$\frac{1}{4}$ lbs.	9.50
No. 3.	$\frac{3}{8}$	$\frac{3}{8} \times 24$	$\frac{1}{8}$	$\frac{1}{8}$ lbs.	10.70
No. 4.	$\frac{1}{8}$	$\frac{1}{8} \times 24$	$\frac{1}{2}$	$\frac{3}{4}$ lbs.	12.50
No. 4.	$\frac{1}{8}$	$\frac{1}{8}$ in. pipe	$\frac{1}{2}$	3 lbs.	12.50
No. 5.	$\frac{1}{2}$	$\frac{1}{2} \times 24$	$\frac{1}{8}$	4 lbs.	16.00
No. 5.	$\frac{1}{2}$	$\frac{1}{4}$ in. pipe	$\frac{1}{8}$	$4\frac{1}{2}$ lbs.	18.00

Made like a valve. Oil tight. Largest reservoir, size for size, of any oil hole covers on the market. Superior in style, finish, utility and uniformity. Samples are our selling agents. Prices subject to discount.

### SELF-CLOSING ROTARY HEAD—STYLE B.



	Size of Head	Size of Thread	Weight Per 100	Nickel Plated Price Per 100
No. 3.	$\frac{1}{8}$ in.	$\frac{1}{4}$ in. 32 pi.	$1\frac{1}{4}$ lbs.	\$12.50
No. 4.	$\frac{1}{2}$ in.	$\frac{1}{8}$ in. 32 pi.	$2\frac{1}{2}$ lbs.	15.00
No. 5.	$\frac{5}{16}$ in.	$\frac{3}{8}$ in. 24 pi.	$4\frac{3}{4}$ lbs.	18.00
No. 5.	$\frac{5}{16}$ in.	$\frac{1}{8}$ in. pipe	5 lbs.	18.00

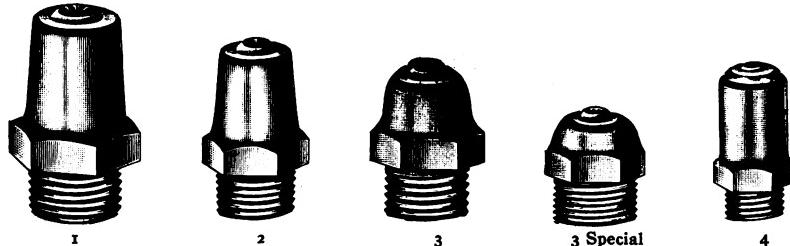
An Oil Hole Cover with self-closing port on the side. Head rotates, placing port in handiest position to lubricate. A cup designed for the operator that never shuts a door or pulls the plug in a wash basin costs more than style A on this account. Taps for all sizes carried in stock.

Sample and discount mailed on application.

Send for Blue Print Dimension Chart

**W. D. & C. F. TUCKER**  
HARTFORD, CONN.

**TUCKER'S SELF-CLOSING TOP OILERS—STYLE C**



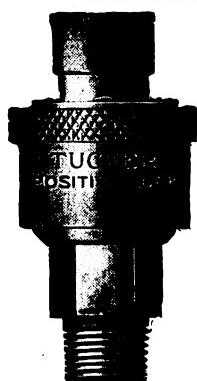
Special sizes and pitches of threads made to order from sketches, quantity making the price. Samples sent on request. Useful in unhandy places with snout of oil can.

	Size of Thread	Size of Hexagon	Weight Per 100	Nickel Plated Per 100
No. 1.	$\frac{1}{4}$ in. pipe	$\frac{5}{8}$ in.	$4\frac{1}{2}$ lbs.	\$20.00
No. 1.	$\frac{1}{2}$ in. x 24 pi.	$\frac{5}{8}$ in.	$4\frac{1}{4}$ lbs.	20.00
No. 2.	$\frac{1}{8}$ x 24 pi.	$\frac{1}{2}$ in.	$2\frac{1}{2}$ lbs.	15.00
No. 2.	$\frac{1}{8}$ in. pipe	$\frac{1}{2}$ in.	$2\frac{1}{2}$ lbs.	15.00
No. 3.	$\frac{1}{8}$ in. 24 pi.	$\frac{1}{2}$ in.	$2\frac{1}{2}$ lbs.	12.00
No. 3.	$\frac{1}{8}$ in. pipe	$\frac{1}{2}$ in.	$2\frac{1}{4}$ lbs.	12.00
No. 3. spec.	$\frac{1}{8}$ in. pipe	$\frac{1}{8}$ in.	$1\frac{1}{4}$ lbs.	11.00
No. 4.	$\frac{1}{4}$ in. 32 pi.	$\frac{3}{8}$ in.	$1\frac{1}{2}$ lbs.	8.00
No. 4.	$\frac{1}{8}$ in. 32 pi.	$\frac{3}{8}$ in.	$1\frac{1}{2}$ lbs.	8.00
No. 5.	$\frac{1}{8}$ in. 32 pi.	$\frac{5}{8}$ in.	$\frac{7}{8}$ lbs.	6.00
No. 6.	$\frac{1}{4}$ in. 32 pi.	$\frac{1}{8}$ in.	1 lbs.	7.00
No. 7.	$\frac{1}{4}$ in. 32 pi.	$\frac{1}{8}$ in.	$\frac{3}{4}$ lbs.	5.50



7

**TUCKER'S POSITIVE LOCK COMPRESSION GREASE CUP**



Fitted with a barrel lock. No springs and washers to depress when feeding the lubricant. Made to gage limits of .002 inch on fit of thread.

List Prices subject to Discount			
No.....	000	00	0
Inside Diameter,			
Inches	$\frac{3}{4}$	1	$1\frac{1}{4}$
Shank Pipe Thread,			
Inches	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{4}$
Grease Capacity,			
Ounces	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{2}{3}$
Plain Brass, each	\$0.90	\$1.10	\$1.35
Polished, each	1.05	1.25	1.50
Nickel Plated, each	1.20	1.40	1.70

Patented Jan. 11, 1910

Cap member has internally milled threads. Base member sized with hand die.

We are prepared to furnish the cap member from pressed brass with milled threads in three sizes— $\frac{3}{8}$ "-000, 1"-00, 0- $1\frac{1}{4}$ ". All with 24 pitch thread, U.S. form.

Send for Blue Print Dimension Chart

# AMERICAN GAS FURNACE COMPANY

Established 1879—Incorporated 1887

24 JOHN STREET - - - NEW YORK

GAS ENGINEERS AND MANUFACTURERS

## SPECIALTIES :

### THE AUTOMATIC HEAT CONTROLLER

Positively regulates heat with no greater variation than 5° Fahrenheit.

### GAS BLAST FURNACES

For all Industrial Heating Processes.

### HEATING MACHINES

For the automatic transmission of work through properly heated space.

### BURNERS AND BLOW PIPES

Of great variety and novel design.

### CASE HARDENING MACHINES

Carbonizing by gas instead of solid carbon.

### ROTATING RETORTS, Sealed

For Annealing, Hardening, Tempering or Coloring steel work.

### ROTARY PRESSURE BLOWERS

Indispensable for proper Gas Combustion.

### CATALOGUES AND DESCRIPTIVE PAMPHLETS

On application.

**THE USES OF GAS** in Mechanical Heating Processes are only **BEGINNING TO BE APPRECIATED**. IT PAYS TO CONSULT US, who are the Pioneers in that line.

## HAUCK MANUFACTURING COMPANY

140 LIVINGSTON ST., BROOKLYN, N. Y.

### "HAUCK" PATENT OIL FUEL BURNERS AND KEROSENE TORCHES

THIS CUT SHOWS HAUCK PATENT INDEPENDENT SELF-CONTAINED TYPE OIL BURNER OUTFIT, FOR KEROSENE OIL ONLY. This outfit consists of the seamless steel tank, equipped with hand air pump, gauge, all the fittings, 12' oil hose, and the patented burner, with regulating valves, special oil needle valve strainer, all complete, ready for use.

This outfit is designed for field and shop work, where compressed air is not available or convenient for use. Flame is easily regulated and always under the control of the operator. Burner operates approximately for two hours, with single pumping of about five (5) minutes.

Hauck patent compressed air style outfits are made for use under any air pressure up to 100 pounds or more, with any grade fuel or crude oil.

HAUCK PATENT PORTABLE OIL FUEL BURNERS are invaluable for service in *Boiler Shops, Machine Shops, Coppersmith Shops, Foundries, Forge Shops, Railway Shops, Shipyards, and for structural work.*

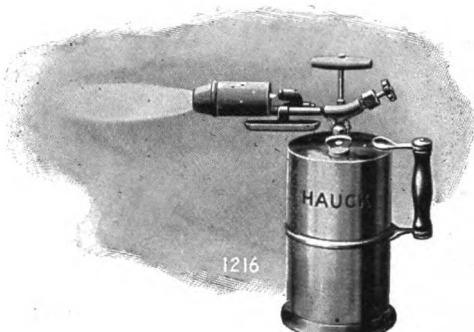
They produce an intense heat which can be applied at any desired point without unnecessarily heating adjacent parts. For welding or straightening broken or bent locomotive frames, straightening out damaged steel plate-work, and for preheating preparatory to any welding process, their worth has been proved by the largest manufacturing firms in the country.

These burners are the most powerful on the market and absolutely reliable.

The price of a burner may often be saved on a single job.



Independent Self Contained Type



KEROSENE TORCH

For light brazing, wiping joints and similar heating operations, this portable blow torch is very efficient, producing an intense clear flame.

It is more suitable for general shop work than the dangerous gasoline torch.

Used largely in foundries and machine shops for drying out moulds, etc.

One Hauck Torch will equal the work of four gasoline torches.

Complete Catalogs on request.



SPECIAL FURNACE BURNERS

This illustration shows a Hauck Furnace Burner operated with compressed air or steam, and any grade of fuel oil. Especially suitable for attaching to boilers and furnaces.

We guarantee Hauck Burners to use less fuel and to give better results than any other make on the market.

J. H. WILLIAMS & CO.  
BROOKLYN, N. Y.

SECURE THE 1912 HAND BOOK OF  
SUPERIOR DROP-FORGINGS

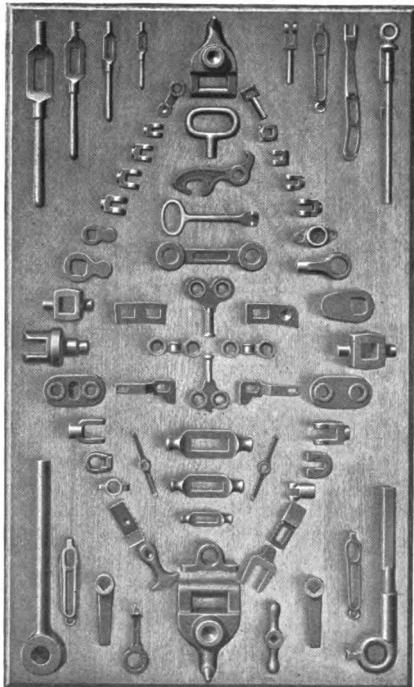
The pocket size book will not only show you the latest standard prices of our many drop-forged stock tools and accessories, but should convince you of our ability to take care of such "made to order" pieces as you may require in connection with your business affiliations.

It will prove a handy reference  
book to you for anything in  
Superior Drop-forgings!

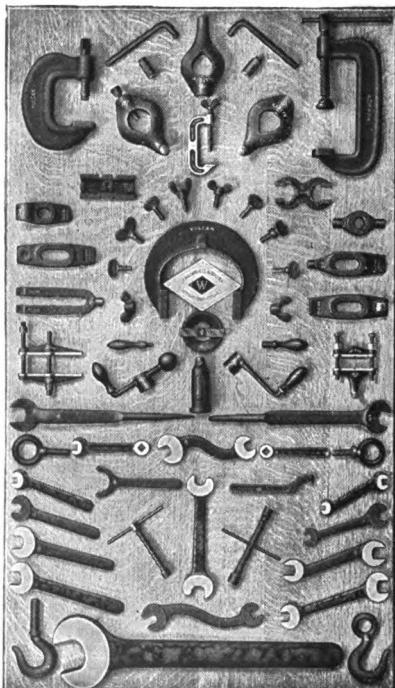
Among the new lines of Drop-forged tools you will notice that the "Vulcan" Safety Lathe Dogs are so constructed that all danger from sleeve contact has been eliminated.

The new "Agrippa" Clamps present unusual features at same price customarily paid for the cast steel product. The drop-forged "Agrippa" Clamps are lighter, stronger, have greater utility and will accomplish everything possible with the heaviest form of cast steel product.

Moreover, you will find interest in a number of other tools which possess points of merit and convenience unique to themselves; secure the book!



Special Forgings



Stock Forgings

# STEEL CAR FORGE COMPANY

FORGING SPECIALISTS

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R. R. Hammond & Company, Phila., Pa.

R. H. Pilson, Washington, D. C.

Adreon Manufacturing Co., St. Louis, Mo.

Rank & Goodell, St. Paul, Minn.

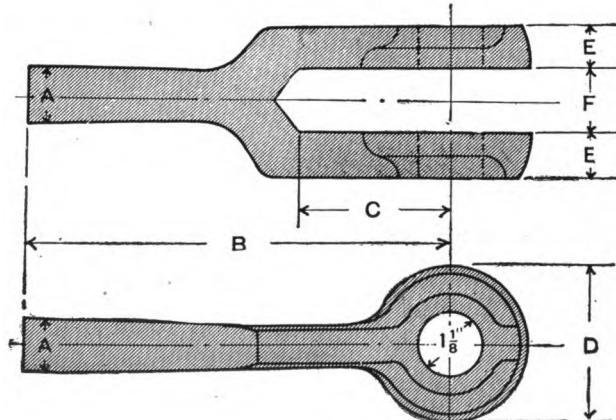
H. D. Cushman Co., Cleveland, Ohio.

Pierson, Roeding & Co., Pacific Coast

We manufacture a full line of iron and steel forgings for standard work, such as freight cars—also for special purposes where castings do not give sufficient strength, having designed many forged parts replacing castings.

Our equipment enables us to furnish to advantage drop forgings, bulldozer or bending work, upset forgings, welding, punching, shearing, eye bending, hooks, etc.

Drop Forged Jaw



Correspondence solicited

# WORCESTER PRESSED STEEL CO.

Factory and Main Office

WORCESTER, MASS.

CHICAGO SALES OFFICE

1243 PEOPLES GAS BUILDING

## HIGHEST QUALITY LIGHT AND HEAVY METAL STAMPING.



Deep Drawing, Cold Rolling, Cold Forging, Pressing,  
Electric and Autogenous Welding, Punching, Blanking,  
Coining, Embossing, Shearing, Squaring, Machining,  
Annealing, Case Hardening, Tempering,  
Heat Treating, Electro-Plating.

### SHEET METAL PARTS TO ORDER FOR

Automobiles	Motorcycles	Lawn Mowers
Textile and	Bicycles	Roller Skates
Electrical Fittings	Cream Separators	Ice Skates
Vacuum Cleaners	Ball Bearings	Pruners
Shock Absorbers	Calculators	Telautographs
Typewriters	Phonographs	Dictographs
Telephones	Sheet Metal Specialties	Handles
Cold Drawn Mouldings	Pulleys	Bowls
Tubing with Seam	Collars	Guards
Flanges	Bushings	Brake Drums
Brackets	Housings	Axle Boxes
Wrenches	Retainers	Looms
Discs	Cups	Clutch Discs
Caps	Hubs	Transmission Cases
Shims	Cases	Stampings

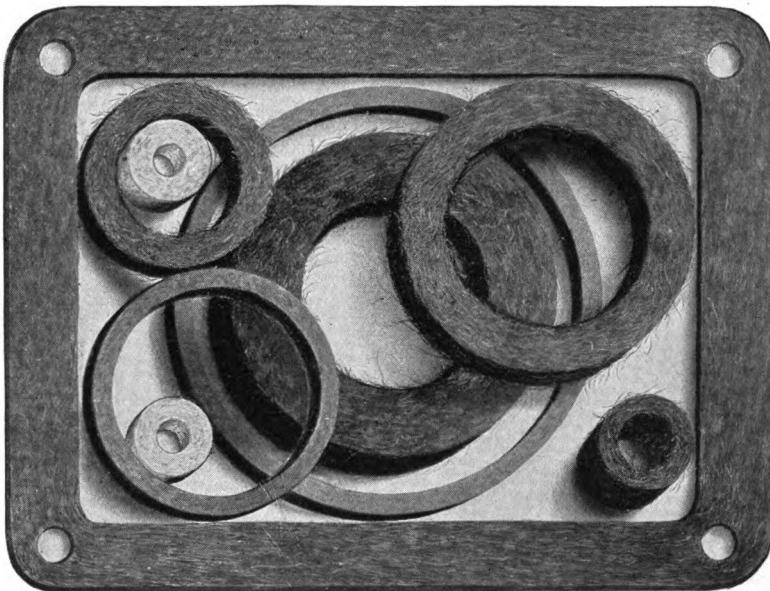
Our entire organization and equipment, developed by 30 years' experience, are devoted exclusively to making special stamped parts for others from strip and sheet steel, brass, bronze, copper, aluminum, silver, monel metal and the new steel alloys. We make all of our own tools. We pickle, oil, shear and cold roll our own steel. We make our own case-hardening compounds.

Our equipment is unsurpassed, 90,000 sq. ft. floor space ; .75 power presses operated by variable speed individual electric motors. We use Connecticut River power 24 hours per day, A. C. and D. C. current ; compressed air ; steam and electric cranes, side tracks, foundry, etc.

## N. E. BOOTH

644 PACIFIC STREET, BROOKLYN, N. Y.

MECHANICAL FELT GOODS OF ALL KINDS



### BOOTH FELT WASHERS, GASKETS, PACKINGS, OIL RINGS, LUBRICATING PADS, ETC.

Booth is a specialist in felts and in the cutting of felts for commercial purposes. He has a three-story factory full of assorted felts, dies, machines, and expert workmen, *and he has a system*. He generally ships on the day after receiving an order,—and he knows how to cut costs as well as felts.

Time was when the user made these articles himself. But it didn't pay. It took too long to get the felt. It cost too much to get the dies. Machines that were built for something else made awkward business of the work.

So Booth stepped in. He designs his own machines. He has shelf upon shelf of interchangeable dies, all made by his own men. The line of round washer dies, for instance, includes every size from  $\frac{1}{8}$  inch to 24 inches. Once in a while some one comes at Booth with an order for felt cut into some freak shape. He hasn't the dies made up, but he has the facilities for making them in a hurry, and the bill is rendered only for material and work. It does not include the cost of dies.

Booth makes a specialty of supplying any of these goods in very small quantities for experimental or test purposes.

Booth saves time and money every day for a lot of big manufacturers in a good many lines of business, and can do the same for you. Ask him about it.

# THE AMERICAN BRASS COMPANY THE COE BRASS BRANCH

ANSONIA, CONN

## EXTRUDED METALS

The word "extrusion" accurately describes the operation by which the various sections are formed.

A billet of brass is first cast of a convenient size and suitable composition for the purpose intended. This billet is re-heated until it is of a plastic consistency, and then, by means of a small crane, it is placed within a very strong horizontal cylinder or "container," at the front end of which is the die. Upon hydraulic pressure being applied at the rear end of the container the plastic metal is forced or squirted through the die, issuing therefrom in a long bar having a cross-section corresponding to the hole pierced in the die.

The very high pressure (oftentimes as high as 60,000 pounds to the square inch) to which the semi-plastic metal is thus subjected gives it increased density and renders it perfectly homogenous and free from possible casting defects. The bars produced by this process have a greater strength and tenacity than those made by rolling or other cold working methods, and for special purposes alloys are made having the requisite strength and elongation for work demanding the strength of good quality steel. It is also obvious that sections which cannot possibly be rolled or drawn can be made by the Extrusion Process with great accuracy.

In addition to bars or rods of irregular cross section, all stock sizes of round, hexagon, square, rectangular, half-round, etc., are produced suitable for forging and all engineering purposes. Alloys used for this purpose are Nickel Bronze, Muntz Metal, and other special bronzes suitable for forging. Free cutting brass rods are made also for manufacturing purposes. The alloys used for making angles, channels, T-bars and special shapes for marine work have a high tensile strength and are particularly non-corrosive in their qualities.

A considerable use that has been found for this metal is in the form of mouldings for architectural work. It is well adapted for use in large stores and office buildings, railroad stations, residences, etc., and can be oxidized to give it any color desired.

Extruded mouldings are also supplied for use in the construction of passenger and sleeping cars, as the metal will take a high finish, is durable, and does not rust out or corrode in service. It is also largely used for step treads, step nosings, platform bindings, hinges, and door stops, having taken the place of brass castings for these purposes. In fact extruded shapes made in a free drilling and free milling stock have superseded castings for many purposes. The metal being perfectly smooth and accurate requires little if any machining, and is utilized in a great variety of manufacturing lines, small pieces being sawed or milled from special shape extruded brass bars to take the place of machined castings. This affords an efficient and economical means for making small, intricate parts such as cams, dogs, pinion wheels, and various other parts that are required in the manufacture of locks, typewriters, telephone and telegraph instruments, switchboards and other electrical apparatus.

The dimensions of the finished bars are limited by the weight of the billets used, and range in weight from 100 to 140 pounds. We are able to produce special shape bars or rods ranging from light sections of about 3-8 in. diameter and weighing a fraction of a pound per foot, to heavy sections 5 or 6 inches in width and weighing many pounds per foot. It will thus be understood that light sections may be had in long lengths and heavy angles, etc., in lengths of from 12 to 18 feet.

## DOEHLER DIE-CASTING COMPANY

BROOKLYN, N. Y., U. S. A.

## DIE-CASTINGS.

The accompanying cuts are photographic reproductions showing the sharp outlines and smooth finish of our castings. These die-castings are made in steel dies by our patented process, and represent the modern economical way of producing finished parts rather than by machining.

Parts heretofore considered machine impossibilities become, by our process, realities. Inventions shelved as impractical or too costly to produce become money makers.

Cheaper production on intricate parts is not the only saving afforded by this process. Die-cast parts are exactly alike, and absolutely accurate, so that time gained in the assembling room is an important factor.

It is a foregone conclusion, considering the expense of a steel-die, that parts wanted in small quantities usually are not die-casting propositions. Cast-iron parts with little machining do not prove any saving, the handicap on the cost of material is too great to overcome to make an attractive showing.

Generally speaking, intricate parts made in brass and used in large quantities yield the greatest saving. However, circumstances and individual cases differ so much that no general rule can be outlined and, therefore, we gladly give our advice on any part at any time, or enter into correspondence on all subjects relating to die-casting with parties interested or seeking information.

The following is a brief attempt to give the main characteristics of our different alloys and their usefulness.

"H" metal. Main ingredient: zinc.

Very hard, wears splendidly as a bearing metal, somewhat brittle against a blow; compares favorably with cast-iron. Will plate in any color.

"T" metal. Main ingredient: zinc.

Alloyed with tin and copper, producing a pliable, tough metal; compares favorably with brass. Will plate in any color.

"L" metal. Main ingredient: lead.

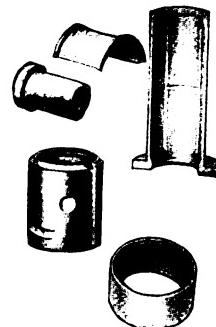
Hardened by tin and antimony. Well adapted for parts to resist steam and water.

"A," "A" metal. Main ingredient: tin.

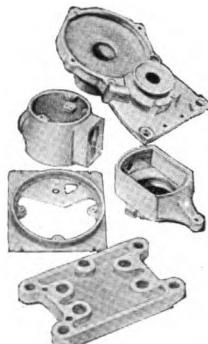
A good, low-priced, non-corrosive, anti-friction babbitt.

"G," "B" metal. Main ingredient: tin.

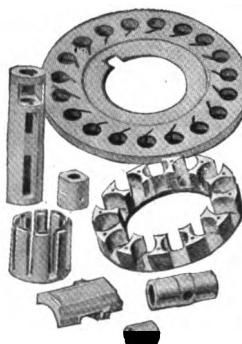
A high-class tin alloy, comparatively hard, non-corrosive; produces castings of high finish and sharpness; wears splendidly in bearings for gas engines. This alloy gives great satisfaction on automobile engine bearings.



Die-Cast Babbitt Bearings and Bushings.



Automobile Accessories.



Ball and Roller Bearing Retainers.

# THE BRAEBURN STEEL COMPANY

BRAEBURN, PENNSYLVANIA

## "THE TOOL STEEL MILL"

### GRADES 1, 2, 3

These grades are carbon crucible steels corresponding in properties respectively to the best makes of standard, extra, and special tool steel. They are made in all tempers and each grade is uniform both as to chemical analysis and method of manufacture as well as to working properties. A reference to our catalogue will give more information regarding these steels.

### GRADE 4

This is a special steel for Turning, Planing and Slotting hard materials, Expensive Cutters, Drills, Forming Tools, Taps, Punches, Dies, etc., and is particularly recommended for all kinds of tools where special endurance is sought and where great strength and toughness are required. This steel is made in all tempers.

### GRADE 5

This is a very hard steel made in one temper only for Turning, Planing, Slotting and working Chilled Iron or any other hard material and especially for those purposes where the tool has to carry a fine edge and has to put a very fine finish on the work. It is not intended for tools which have to withstand shocks like the blows of a hammer or sledge.

**Treatment.** This steel should be given more time in heating for forging and hardening than other tempering steels. For forging, heat slowly and uniformly to a bright red, then forge the tool, using light blows as the heat dies out; do not hammer at a black heat. For hardening, reheat to a dark red and quench in warm water.

Use a wet grindstone in grinding tools made from this steel.

### GRADE 6

This is an oil hardening steel, made only in one temper, for Milling Cutters, Taps, Reamers, Gauges, Hard Steel Bushes, Ball Bearings and other purposes where it is particularly desired there shall be neither contraction nor expansion after hardening.

**Treatment.** For forging, heat slowly and uniformly to a bright red, harden at a dull red, about 1350 degrees Fahrenheit and draw the temper only sufficiently to relieve the strain. Hardened in this manner it is very tough and takes an excellent cutting edge and practically obviates all contraction and expansion.

### GRADE 7

This is a deep hardening steel and is especially recommended for Twist Drills and is made in all tempers.

### SELF HARDENING

This is a special alloy steel which cannot be cut or punched cold but can be shaped or ground on a stone or emery wheel. It is suitable for moderately high speeds where great strength is not necessary.

### HIGH SPEED STEELS

Made in two grades known as "High Speed" and "High Speed Special."

The HIGH SPEED STEEL for Punches, Boring Tools, Straight Drills, Twist Drills, Milling Cutters, Gear Cutters, etc., is capable of doing all the work of ordinary machine shop equipment with heavy cuts and coarse feed at either high or low speed.

The HIGH SPEED SPECIAL STEEL is for purposes similar to those for which the High Speed Steel is made but is adapted more particularly to cases where the service is unusually severe. We recommend the use of this steel only where unusual service is demanded or where it is desirable to use a tool for a considerable length of time without re-grinding. This steel, owing to its superior quality and toughness, of course holds its edge longer and stands greater strains than does the High Speed Steel, but its use is hardly necessary or economical except under unusually severe conditions.

### B. T. GRADE

A common tool steel suitable for Springs, Shafts, forgings, Hammers, Picks, Forks, Rakes, Hoes, Corn Stalk Cutters, Cutlery, Lawn Mowers, Harvesting Machinery, Wedges, Wedges, Die Blocks, Cant-Hooks, Files, etc., or wherever well selected and carefully worked steel is used.

# THE COLONIAL STEEL COMPANY

PITTSBURGH, PENNSYLVANIA

## HIGH GRADE STEEL

### COLONIAL HIGH SPEED STEEL

Adapted for the heaviest cuts or the highest speeds on all classes of material. Colonial High Speed Steel is made in one grade only and is capable of doing any class of work for which high speed steel is suited.

### COLONIAL BEST TOOL STEEL, WATER HARDENING

An alloy steel adapted for fine finishing cuts, such as forming tools, cutters, hobs, threading dies, etc.; for brass and copper lathe tools, and other purposes where machines are not equipped to use high speed tool steel.

### COLONIAL NO. 7 TOOL STEEL, WATER HARDENING

A vanadium tool steel of great strength and toughness; made from pure wrought iron, and suitable for high-class tools of all kinds, especially those subject to strain or stress of any kind through repeated action or repeated shock.

### COLONIAL SPECIAL TOOL STEEL, WATER HARDENING

A straight carbon tool steel, made from pure melting iron. Suitable for shop tools of all kinds.

### RED STAR TOOL STEEL

Standard grade for ordinary purposes.

### RED STAR DRILL STEEL

For rock drilling purposes.

### NICKEL STEEL

Bars and Billets made in small furnaces and carefully melted to insure homogeneous steel. Furnished free from pipes, seams and all defects.

### 30 PER CENT NICKEL STEEL

Anti-corrosive. Used for valve stems and parts of internal combustion engines. or other purposes where material is desired that will not rust or corrode.

### SHEET STEEL

For knives and tools of all kinds, springs, agricultural implements, etc.

### SOFT CENTER PLOW STEEL

Made in slabs or sheared to pattern, carefully manufactured, and special attention given to the toughness of center, and rigidly inspected.

### FIVE PLY JAIL BARS AND SAFE PLATES

Send for Catalog

## HALCOMB STEEL COMPANY

SYRACUSE, N. Y.

### BRANCHES, AGENCIES AND STOCKS :

Halcomb Steel Co., Syracuse, N. Y.                    Halcomb Steel Co., Cleveland, O.  
Halcomb Steel Co., Philadelphia, Pa.                    Halcomb Steel Co., Chicago, Ill.  
Hawkrige Bros. Co., Agents, Boston, Mass.

**HIGH SPEED STEEL, TOOL STEEL, SHEET STEEL, DRILL RODS, FINE WIRE, COLD DRAWN STEEL AND SPECIAL STEELS OF ALL KINDS**

### HALCOMB SPECIAL HIGH SPEED TOOL STEEL

This steel is unsurpassed by any product, foreign or domestic, where the most severe duty is demanded, as in heavy lathe and planer work, boring tools, turning glazed tires, alloy steel gears, flat and twisted drills. It is noted for consistent uniformity of analysis, and does not require fussy treatment.

The risk of breaking in hardening is minimized and tools cannot be ruined by over-heating. These steels are also readily annealed for machining. Cutters and fragile tools do not require a sweating heat when made from our steels. They retain an excellent cutting edge, and hence show high efficiency for both roughing and finishing work.

### HALCOMB KETOS OIL HARDENING TOOL STEEL

The greatest achievement in tool steel since the discovery of high speed steel. There is a place for this steel in every shop and tool room. This steel neither expands, contracts nor warps in hardening. Safest steel ever produced from which to manufacture intricate tools, dies, cutters, etc. Think of making a twenty-two inch tap with no change in pitch after hardening! Write for special booklet on Ketos.

### HALCOMB SPECIAL TOOL STEEL

This steel is made in six tempers (varying from high to low carbon), to meet all tool steel requirements.

For turning, planing, and slotting hard materials, for expensive cutters, drills, forming tools, taps, reamers, punches, dies, etc.

Particularly recommended for all kinds of tools where special endurance is sought and where great strength and toughness are required.

### HALCOMB EXTRA WARRANTED TOOL STEEL

This steel is made in six tempers to meet varied requirements, and is of fine quality, suitable for many kinds of tools, including wood-working bits and knives, cold chisels, drills, mining drills, granite tools, lathe and planer tools, cutters, taps, reamers, dies, shear blades, punches, etc. An excellent steel for general use.

### OTHER TOOL STEELS

Other well-known brands of tool steels manufactured by this company are:

"Air Hardening Tool Steel"	"Double Special Tool Steel"
"Double Extra Tool Steel"	"Extra Special Tool Steel"
"Peerless Tool Steel"	"Standard Tool Steel"

Catalogues on request

## HALCOMB STEEL COMPANY

### PIONEER AMERICAN MAKERS OF ELECTRIC FURNACE ALLOY STEELS

These steels are chemically pure and free from sulphur, phosphorus and gases. They are completely deoxidized, thoroughly melted, homogeneous, and free from segregation, seams, and surface defects. They are easy to machine and respond with certainty to any definite heat treatment. They are very readily drop forged, and are not apt to be injured by over-heating.

Electric Furnace alloy steels have wide hardening ranges, so that uniform results can be had in plants not equipped with the latest devices for controlling temperatures. In resistance to fatigue they stand from 50% to 100% better than corresponding compositions made by other processes.

We make a specialty of Alloy Spring Steels, which are characterized by greater strength and fatigue values than ordinary spring steels. They thus permit of greater fibre stresses without sacrificing present factors of safety, and consequently make possible substantial reductions in weight.

These alloy steels are especially well suited for the construction of machine tool and automobile parts.

### ELECTRIC NICKEL STEEL

Nickel Steel is perhaps the most generally useful of the alloys. In various conditions of thermal treatment, it displays wonderfully good qualities, and is well suited to the production of structural parts. It case-hardens well, and in machining qualities is superior to the usual alloy steels.

### CHROME VANADIUM STEELS

The manufacture of genuine Crucible or Electric Chrome Vanadium Steels constitutes the highest attainment of the steel makers' art. By the proper blending of these alloying metals and adjustment of the carbon, we not only obtain every static property that can be obtained from Nickel, Chrome Nickel, Silico-Manganese or other alloys, but also obtain wonderfully enhanced dynamic or antifatigue qualities.

In general, when a better material than Nickel Steel is needed, we unreservedly commend our Chrome Vanadium Steels.

### OTHER ELECTRIC FURNACE ALLOY STEELS

The Halcomb Steel Company also manufacture Chrome-Nickel Steel, Chrome-Silicon Steel, Silico-Manganese Steel, and other alloys to meet special requirements.

### COLD DRAWN AND COLD ROLLED STEEL

We are prepared to furnish cold drawn steel from .007 in. to 3 in. diameter in rounds and corresponding sizes in squares, flats and special shapes, exact to size.

### HEAT TREATING AND ANNEALING

We are prepared to furnish any of our products, either tool or alloy steels, hammered or rolled, in the form of billets, bars or forgings, and unannealed, annealed or oil-tempered. Our heat-treating facilities are unexcelled, thoroughly modern and up-to-date in every way and under competent technical supervision. We act in an advisory capacity for our customers in reference to all matters pertaining to heat-treatment and heat-treating equipment, pyrometers etc.

## PARKESBURG IRON COMPANY

PARKESBURG, PENNSYLVANIA

1023-30 Church St., New York

1613 Fisher Bldg., Chicago

822 Arcade Bldg., Philadelphia

### REPRESENTATIVES:

ARTHUR C. HARVEY CO., Boston  
WOODWARD, WIGHT & CO., LTD., New Orleans

EAGLESTON PARKE, INC., Norfolk  
H. A. FULLER IRON & STEEL CO., St. Louis

**CHARCOAL IRON BOILER TUBES, CHARCOAL IRON ARCH TUBES,  
CHARCOAL IRON SAFE ENDS, CHARCOAL IRON SUPERHEATER TUBES.**

Our entire output consists of genuine old-fashioned charcoal iron, which resists pitting and corrosion, is free from crystallization, preserves its ductility and gives the lowest ultimate cost of boiler tube installation.

**BOILER TUBES AND SUPERHEATER TUBES.** Range of sizes, 1½" O. D. to 6" O. D.

Owing to the careful attention given all details, tubes produced by the Parkesburg Iron Company have remarkably few blisters, run true to gauge, and are of so soft and ductile a nature that they bead over the flue sheet with the greatest ease, and rarely require rerolling after installation.

For boiler and superheater tubes, charcoal iron is eminently suited. It is of a fibrous nature, and will not crystallize under shock or vibration. It is ductile, can be beaded easily and securely, and requires little calking. It is preeminently weldable. It is non-corrosive and will not pit.

**ARCH TUBES.**—Careful attention is given to arch pipe, which are furnished from the "Parkesburg Special" grade of iron identical with the former "Allison Special" which was favorably known for arch pipe in the past. As on the quality of arch pipe the lives of engineers and firemen are dependent, "Parkesburg Special" quality is recommended as being the safest on the market. The range of sizes of arch pipe and water grate is 1 7-8 inches to 4 inches, outside diameter, and from No. 10 B.W.G. to 5-16 inch thick.

**SAFE ENDS.**—The Parkesburg Iron Company has met with great success in safe ends both cut to length and in random lengths. These safe ends are furnished of charcoal iron and if required to American Master Mechanics Association Specifications, or of Solid Swedish Charcoal Iron, their advantage over steel being due to the fact that they can be welded to the body grade flue securely and permanently, thereby avoiding accidents to flues in service through failures at the weld.

**SOME OF THE ADVANTAGES OF GENUINE CHARCOAL IRON ARE AS FOLLOWS:—**It is not easily corroded or affected by electro-chemical action, being nearly pure iron. Because of its homogeneous structure, low manganese, and the intimate mixture of cinder surrounding each filament of iron it is not apt to become pitted.

It has unusually good welding qualities. It is very fibrous and ductile, and under test, shows uniformly distributed elongation. It is not subject to crystallization under vibration or shock.

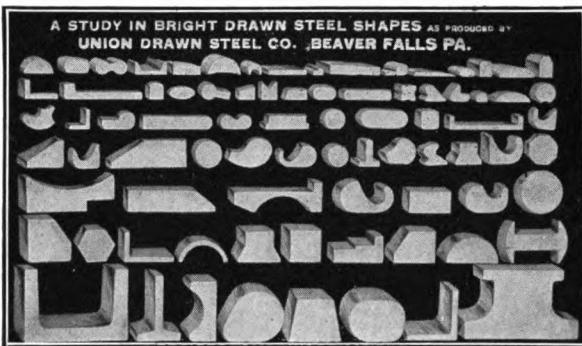
Write for complete catalogue.

## UNION DRAWN STEEL COMPANY

Works and General Office  
BEAVER FALLS, PA.

Warehouses: New York, Philadelphia, Chicago, Cincinnati.  
Branch Sales Offices: Boston, Buffalo, Atlanta.

**MANUFACTURER OF BRIGHT FINISHED STEEL EXCLUSIVELY IN ROUNDS, SQUARES, HEXAGONS, FLATS AND SHAPES, SHAFTING, SCREW STEEL, AXLE STEEL, BESSEMER, OPEN HEARTH, CRUCIBLE, NICKEL AND VANADIUMS, DRAWN—COLD ROLLED AND TURNED STEEL.**



**SPECIAL SHAPES OF COLD DRAWN STEEL** of any dimensions within our range and for all purposes, will be made in the shortest possible time consistent with perfection in quality, in accordance with specifications furnished, where sufficient quantity will justify equipment.

The most comprehensive stock of Bright and Finished Steel, Rounds, Squares, Hexagons and Flats carried at our branch warehouses, in addition to the large stock we carry at our mill.

We are the largest manufacturers of cold finished steel and iron for shafting and various machinery uses.

Established 1889, but rebuilt Fireproof Plant and all new machinery installed, 1911.

**SHAFTING.**—We use only the best quality of soft steel and are manufacturing under recent patents, covering machinery and appliances, by a process superior to anything known for producing work mathematically accurate as to size, absolute straightness, and a perfectly polished surface.

**PISTON AND PUMP RODS.**—For piston and pump rods we use a special grade of steel, and can produce them strictly uniform in size and quality, highly polished, perfectly straight, and of lengths up to 60 or 70 feet.

**SCREW STEEL.**—For this work we furnish a special analysis of steel, which, after years of experiment, has proved best adapted to free cutting and threading, and for the production of the maximum number of parts in the minimum of time, by the use of automatic and hand screw machines and Turret lathes.

**SPECIAL STEEL.**—For the various places where special grades of steel are required, our experience and facilities are such that we can promptly furnish material best adapted for the special requirements.



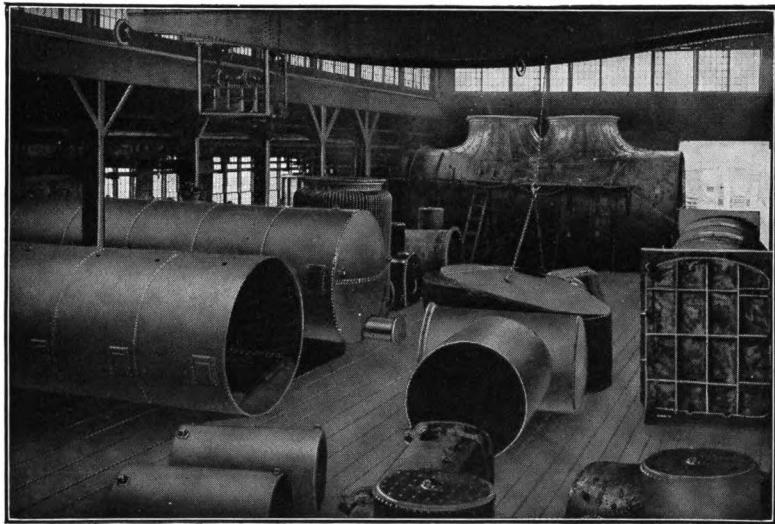
## STRUTHERS-WELLS COMPANY

Established 1851

WARREN, PENNSYLVANIA

N. Y. Office, 50 Church St

ANYTHING IN STEEL PLATE CONSTRUCTION FOR BEET SUGAR REFINERIES  
PAPER MILLS, OIL REFINERIES, SOAP FACTORIES, WOOD ALCOHOL AND  
TURPENTINE PLANTS, TANKS (FOR STORAGE OR PRESSURE) WITH  
EITHER WELDED OR RIVETED SEAMS. PENSTOCKS, RIVETED  
PIPE FOR HYDRAULIC AND STEAM PRESSURE, EXHAUST  
PIPES, STEAM HEADERS, EXHAUST HEATERS,  
BRICK HARDENING CYLINDERS, GALVANIZ-  
ING POTS, RETORTS, STILLS, AGI-  
TATORS, STEAM PANS, AND  
JACKETED KETTLES



*View of one corner of Erecting Floor*

We will contract to furnish specially designed work in steel plate from customers' plans and specifications, either completely built up in the shop or assembled, knocked down and shipped in sections as may be called for.

Our equipment and experience enable us to handle both intricate and simple work with equal ease and dispatch. Our workmanship will pass the most rigid inspection.

We maintain a fully equipped estimating department at our shops and also at our New York Office. This enables us to furnish prices promptly.

If you want a specially designed piece of work, send us your drawings and specifications,—we have probably built it before, or at least something very similar to it.

Smoke breechings, stacks and air flues for modern buildings are right in our line.

## THE PETROLEUM IRON WORKS CO.

SHARON, PA.

NEW YORK

ST. LOUIS

HOUSTON, TEXAS

FABRICATORS AND ERECTORS OF EVERY VARIETY OF LIGHT AND HEAVY STEEL PLATE CONSTRUCTION.

TANKAGE FOR ALL PURPOSES LARGE OR SMALL; OIL REFINERY EQUIPMENT, STAND PIPES, WATER TOWERS, SMOKE STACKS, PENSTOCKS, RIVETED STEEL PIPE, BLAST FURNACES, HOT METAL LADLES, BOILERS, ANNEALING BOXES, "LEMAN" COUNTER CURRENT CONDENSERS, "GEM" FUEL OIL BURNERS, "WASHINGTON" AUTOMATIC OIL AND GAS SEPARATORS, PORTABLE RECEIVING TANKS, CAR TANKS ETC.

The Petroleum Iron Works Company is located on a property of forty acres, situated about three miles south of Sharon, Pa.

Our railroad facilities here are excellent, as the works have direct connections with the New York Central, the Erie and the Pennsylvania Railway Systems. Our trackage for receiving and shipping inbound and outbound freight is more than a mile in length, thus affording ample space for car storage and ideal facilities for making shipments. Car shortages and delays occurring where there is but one railroad connection are practically unknown in this district. We, therefore, feel sure the trade will fully appreciate this condition, as it enables us to guarantee our promises of delivery to points in every direction.

Our present plant consists of a substantial steel structure, fully equipped with modern machinery, tools and appliances, which insure accurate and rapid production. We are now in position to give our customers better satisfaction and more prompt service than ever before. Superior manufacturing facilities and careful shop inspection will continue to maintain our long established reputation for high class work.

It is difficult to prepare a catalogue that will adequately describe and illustrate all the classes of sheet metal structures and apparatus that we are in position to furnish and erect. The illustrations presented are shown merely as types of our various lines of work, among which we might enumerate the following:

<b>Oil Storage Tanks (large and small)</b>	<b>Railroad Water Service Tanks</b>	<b>Converters</b>
<b>Acid Storage Tanks</b>	<b>Oil Refineries (complete)</b>	<b>Hot Metal Ladles</b>
<b>Water Tanks</b>	<b>"Leman" Counter Current Condensers</b>	<b>O. H. Furnaces</b>
<b>Water Softener Tanks</b>	<b>"Washington" Automatic Oil and Gas Separators</b>	<b>Pulp Digesters</b>
<b>Molasses Tanks</b>	<b>"Gem" Fuel Oil Burners</b>	<b>Galvanizing Kettles</b>
<b>Turpentine Storage Tanks</b>	<b>Riveted Steel Pipe</b>	<b>Creosoting Cylinders</b>
<b>Grain Tanks</b>	<b>Flumes</b>	<b>Condenser Boxes</b>
<b>Tar Tanks</b>	<b>Penstocks</b>	<b>Coal Bins</b>
<b>Hydro-Pneumatic Tanks</b>	<b>Blast Furnaces (complete)</b>	<b>Steam Separators</b>
<b>Pressure Tanks</b>		<b>Air Receivers</b>
<b>Filter Tanks</b>		<b>Water Towers</b>
<b>Car Tanks</b>		<b>Stand Pipes</b>
<b>Portable Receiving Tanks</b>		<b>Smoke Stacks (Self-Supporting and Guyed)</b>
		<b>Breechings, etc., etc.</b>

Frequently special problems arise, and in such cases we are glad to offer the services of our Engineering Department. In order to assure prompt replies to inquiries we respectfully request complete detail information, including specifications and blue prints when possible. We hope by prompt and careful attention to our customers' inquiries to be favored with at least a portion of your valued orders.

We issue no discount sheet owing to the constant fluctuations in prices, and for the reason that practically all of our products are built to order.

# THE PETROLEUM IRON WORKS CO.

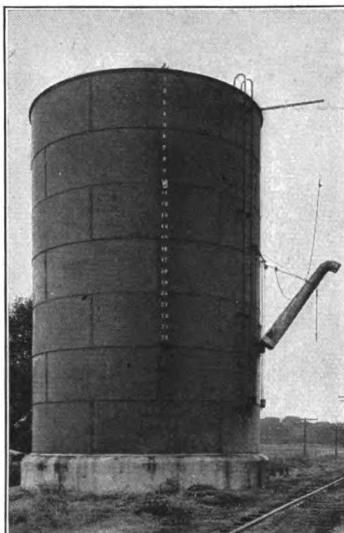
OIL REFINERIES—COMPLETE



10' x 30' Single, Double, and Triple Compartment Cylindrical Horizontal Oil Storage Tanks ready for shipment.



150 000 Gallon Water Tower,  
Yonkers, N. Y.  
(Height over all 184')



R. R. Water Service Tank.  
Erected East Waco, Texas, for the  
"Cotton Belt."

## CROCKER-WHEELER COMPANY

AMPERE, N. J.

MANUFACTURERS AND ELECTRICAL ENGINEERS.  
MOTORS, GENERATORS, TRANSFORMERS.



### AC GENERATORS. OF ALL SIZES.

Of superior design and construction. Special advantages gained by C-W exclusive features. Write for our bulletins 143, 135 and 150.

### DC GENERATORS. ALL SIZES.

These machines are known among engineers for the special care and attention given to every feature of their design and construction. Send for our bulletins 153 and 121.



### INDUCTION MOTORS. ALL SIZES.

These motors combine high efficiency, low starting current, great overload capacity and high power factor with strong insulation and ease of repairs. They will operate continuously with very little attention.

Bearings adjustable for wear.

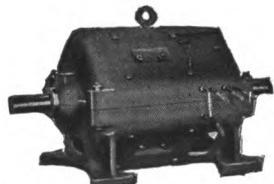
Metallic slot wedges, allowing the use of form wound coils plus the advantages of closed slots. Write for our bulletins 141 and 146.



### DC MOTORS OF ALL TYPES SIZES FROM 120 TO 5000 H. P.

These motors are a C-W specialty and have been developed to stand hard service and abuse. Their quality is due to good design and thorough construction.

Send for our bulletin 142.



### SPECIAL ROLLING MILL MOTORS.

Built with fire-proof insulation and all parts made extra strong and heavy for rolling mill service. The C-W Co. has made a specialty of this class of motors, and can promptly supply motors for any branch of Rolling Mill service.

Write for our bulletin 128.



### POWER AND LIGHTING TRANSFORMERS.

These transformers are built for long service and efficiency. They operate with the minimum loss of energy, saving 15% or 20% of the amount lost by the average transformer.

Send for bulletins 151 and 154.

# DIEHL MANUFACTURING COMPANY

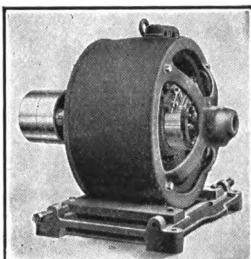
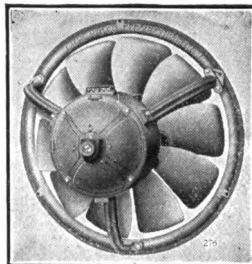
ELIZABETHPORT, N. J.

## ELECTRICAL APPARATUS



### VENTILATING OUTFITS DIEHL MOTOR DIRECT CONNECTED TO EXHAUST WHEEL

The illustration shows one of the many types which is carried in stock by the Diehl Manufacturing Company, who have standardized a slow speed totally enclosed motor for ventilating purposes. Particular emphasis is laid upon the enclosed type of motor from the fact that the entire volume of dust laden air handled by the wheel must pass over the motor and not through it.



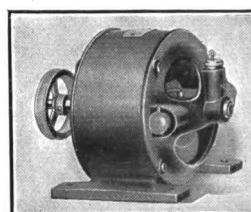
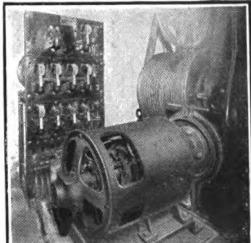
### TYPE "G" MOTORS

For general power uses this line of motors is exceptional for low temperature rise and sparkless operation within guaranteed load limits without change in brush position. Soft steel is used for the cast welded magnet cores. A vacuum impregnating process gives thorough saturation to the field coils with the insulating compound. All machining operations being performed on the yoke with one setting insures concentricity of all parts. Type "G" motors are made for Direct Current only and are of three varieties, open, semi-enclosed with wire screens and enclosed with iron doors.

### TYPE "K" MOTORS

Type "K" apparatus as built for adjustable speeds gives the full range of rated speeds by field resistance, having a culminating ratio of 5-1. This apparatus is more compact in its dimensions than any other on the market having similar characteristics, without sacrificing strength and durability.

Elevator motors subject to heavy starting torque, quick acceleration and sudden fluctuating load must blend the characteristics of wide speed range with sparkless commutation and low temperature rise. Type "K" applied to elevator drive gives positive assurance of success.



### "GL" AND "GS" MOTORS

Small motors for general power uses showing a range of power from  $\frac{1}{16}$  to  $\frac{1}{4}$  HP are listed under the title of "GL" "GS" Motors in Bulletin No. 76.

The smaller sizes are constructed to run either D. C. or A. C. circuits. Having wholly laminated field frame and being enclosed with light sheet metal covers, weight is minimized. "GS" type motors are built for D. C. current only with either series, shunt or compound windings.

## ELECTRO-DYNAMIC COMPANY

BAYONNE, NEW JERSEY

### THE INTER-POLE MOTOR

The use of Direct Current Motors before the introduction of the INTER-POLE was rapidly decreasing, because the A. C. Induction Motor for Constant Speed Working had certain advantages, such as no attention being required to brushes or commutator.

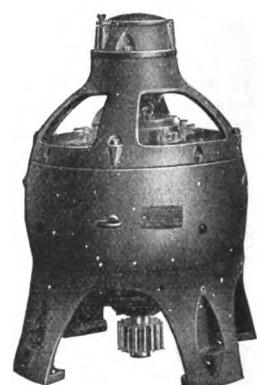
The advent of the INTER-POLE Motor has changed this condition, because there is no commutator or brush trouble encountered with such—besides it has many other extremely useful characteristics not possessed by its predecessors for either A. C. or D. C. Circuits.

The INTER-POLE Motor, therefore, has fixed and established the basic principles on which all good D. C. Motors must be constructed. It constitutes the greatest advance in electric motive power in the last twenty years and HAS SAVED THE DAY FOR DIRECT CURRENT FOR MOTOR WORK.

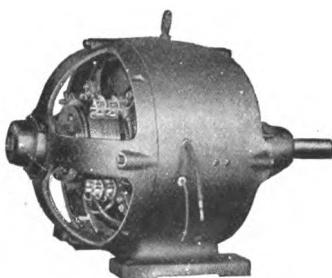
This Company is the Pioneer of the INTER-POLE Motor development and has created a standard of merit by which all motors are judged.

For either Constant or Adjustable Speed Service these motors have certain inherent advantages, among which are the following:

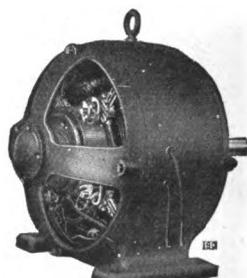
- 1st: SPARKLESSNESS.
- 2nd: High Efficiency.
- 3rd: Reversibility.
- 4th: Heavy overload capacity.
- 5th: Compactness.
- 6th: Constant speed at any controller position regardless of load.
- 7th: Wide speed ranges. Speed ratio up to 1 to 6 by shunt field control.



Type "S" vertical motor—Ball bearings.



Type "S" motor—commutator end  
Ring oiler bearings



Type "S" motor—commutator end  
Ball bearings.

A comparison of ratings and prices with other makes of motors will show that prices of the INTER-POLE Motors are competitive, even with motors not having INTER-POLES. This fact, together with the well-known high quality, will warrant the use of these motors exclusively.

Bulletins will tell the whole story. Send for them.

# RICHMOND ELECTRIC COMPANY

## RICHMOND, VIRGINIA

### List of Branch Offices and Sales Representatives

Atlanta, Ga.	72 Marietta Street	Fulton Electric Co.
Baltimore, Md.	204 N. Calvert St.	John S. Dobler
Birmingham, Ala.	3 So. 20th St.	Oliver Electric & Machine Co.
Boston, Mass.	141 Milk Street	B. B. Stoddard
Chattanooga, Tenn.	Cor. Duncan Ave. & R. R. St.	Chattanooga Armature Works
Chicago, Ill.	322 Monadnock Block	Richmond Electric Company
Cincinnati, Ohio	126 W. 2nd Street	Buckeye Equipment Company
Cleveland, Ohio	505 Sweetland Bldg.	The F. Bissell Company
Columbia, S. C.	804 W. Gervais Street	Gibbs Machinery Company
Dallas, Texas	1413 Commerce Street	Gus Sachs
Davenport, Iowa	119 E. 4th Street	Tri City Electric Supply Co.
Detroit, Mich.	1006 Majestic Bldg.	The F. Bissell Company
Louisville, Ky.	514 W. Main Street	Harry I. Wood Company
Lynchburg, Va.	614 Main Street	Hudson-Morgan Electric Co.
Memphis, Tenn.	28 S. 2nd Street	Gray Brothers
Moline, Iowa		Tri City Electric Supply Co.
New Orleans, La.	Baronne & Peridodo Sts.	Interstate Electric Co.
New York, N. Y.	145 Chambers Street	Richmond Electric Company
Oklahoma City, Okla.	116 N. Broadway	Arnold & Wetherbee
Philadelphia, Pa.	1011 Chestnut Street	Richmond Electric Company
Pittsburg, Pa.	430 Penn Ave.	John McC. Price Company
Rochester, N. Y.	33 Exchange Street	L. Larsen
St. Joseph, Mo.	820 Frederick Ave.	Columbian Electric Company
St. Louis, Mo.	1318 Pine Street	Richmond Electric Company
San Francisco, Cal.	Monadnock Bldg.	A. C. Hanna
Toledo, Ohio	226 Huron Street	The F. Bissell Company

### "RICHMOND" POLYPHASE MOTORS

By devoting their attention exclusively to the design of Polyphase Motors the engineers of the Richmond Electric Company have brought its product to an unusually high degree of perfection.

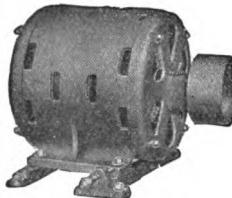
"Richmond" Motors are manufactured in both the Squirrel Cage and Wound Rotor types.

#### SQUIRREL CAGE MOTORS

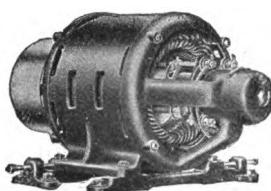
The standard type R. E. (squirrel cage) motors are built in sizes from  $\frac{1}{4}$  to 150 h.p. Instead of auto-starters "RICHMOND" type R. E. motors are equipped with a special starting winding (covered by U. S. Patent of Feb. 12, 1907).

This form of starter has many advantages over the compensator method. "RICHMOND" Motors will develop a higher starting torque with less current than will motors using compensators.

Motors of 5 h.p. are supplied with these starting coils when so specified.



Illustrating 112 frame,  
30 h.p. 1140 R. P. M. Squir-



50 h.p. 1140 r.p.m. 60 cycle wound rotor type motor. This gives a very accurate idea of the entire lines of type F.H. and E.M. slip ring motors in sizes from  $\frac{1}{4}$  to 75 h.p.

This type machine is most desirable for work requiring a powerful starting torque, as in this respect it is far superior to the squirrel cage motor.

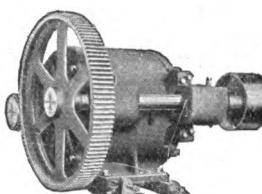
Type E. M. Slip Ring Elevator Motors are rated for intermittent service. These motors are unusually well adapted for the operation of freight and passenger elevators, cranes, hoists, etc. In mechanical construction they resemble the constant service type F. H. motors, but have a higher starting torque.

#### WOUND ROTOR TYPES Type F. H. Slip Ring Motors

An appreciation of the demand for a satisfactory variable speed polyphase alternating current motor has caused this company to place upon the market a full line of machines of this character, ranging in size from one-fourth to 125 h.p. inclusive.

These motors will be found most satisfactory for the operation of printing presses, ventilating fans and other apparatus requiring variable speed.

These motors resemble very closely in operating characteristics a direct current shunt motor with armature control.



Back Geared Motors can be supplied in all sizes in either the R.E. or F.H. types Standard ratio is 5-1.

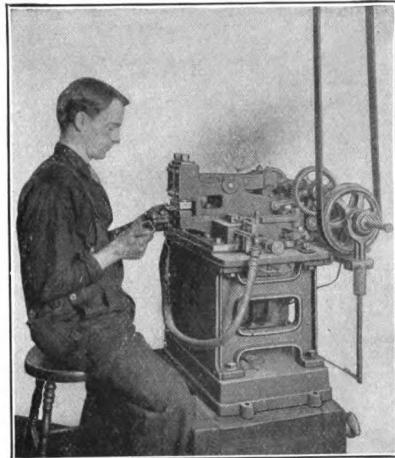
# THOMSON ELECTRIC WELDING CO.

LYNN, MASS.

A COMPLETE LINE OF ELECTRIC WELDERS FOR BUTT, SPOT AND SPECIAL WELDING, OPERATED BY HAND, FOOT, SEMI-AUTOMATIC AND AUTOMATIC CONTROL.

## SPECIAL WELDERS A SPECIALTY

### TYPE 7A AUTOMATIC



For welding rings, hoops, buckles, etc.

Machine-made in various forms,  
making 10-20 welds per minute.

### COST, TIME, POWER

Iron-Steel Ro. sq. in.	Area. sq. in.	Horse- Power H.P.	K.W.	Seconds	Approx. K.W. hrs. 1000 Welds
.05	.05	5	4	2	5
.11	.11	6	6	3	15
.20	.20	9	9	6	30
.31	.31	12	12	10	65
.44	.44	15	15	15	90
.60	.60	18	18	18	113
.79	.79	20	20	20	167
.99	.99	25	25	24	275
1.23	1.23	30	30	33	422
1.77	1.77	38	38	40	640
2.41	2.41	48	48	48	1000
3.14	3.14	60	60	60	

### COST

Multiply the K.W. hours used by the number of cents your current costs per K.W. hour, and you get the current cost per 1000 welds for sizes shown on above table.

### TIME

The time of welding runs from 1-5 second in small wire to 60 seconds in sections such as 3 square inches.

### POWER

The power varies from 1 K.W. for 1-5 second to 60 K.W. for 60 seconds. Within certain limits the GREATER THE POWER, THE LESS THE TIME; and VICE VERSA. DIRECT CURRENT cannot be used, the welder being operated upon a single-phase of any constant potential ALTERNATING current, from 110 to 500 volts.

### SPECIFICATIONS OF STANDARD TYPES

TYPE.	Approx. Weight Lbs.	DESCRIPTION	DIMEN- SIONS			Max. K.W. Trans. Capacity	Approx. Equivalent Horse-Power	WELDING CAPACITY			
			Inches	Length	Width			Min. Inches Ro.	Max. Inches Ro.	Min. Inches sq. in.	Max. Inches sq. in.
1AA	90	Semi-Automatic	16	11	13	1.5	2	No. 23	wire	No. 15	.003
2A	150	Semi-Automatic	15	12	15	3.	4	No. 16	.003	1/4	.05
2AA	140	Semi-Automatic	13	14	15	3.	4	No. 16	.003	No. 6	.03
2A	200	Automatic	16	24	17	3.	4	No. 16	.003	No. 6	.03
3A	500	Automatic	29	23	44	4.5	6	No. 10	.02	1/4	.05
5A	525	Semi-Automatic	27	15	18	7.5	10	No. 8	.02	3/8	.11
5A	525	Hand	27	15	18	7.5	10	1/4	.05	5/8	.30
5AA	550	Semi-Automatic	27	15	20	7.5	10	No. 6	.03	1/4	.05
7A	800	Automatic	31	24	36	6.	8	No. 8	.02	1/4	.05
10A	900	Hand	32	16	32	15.	20	3/8	.11	3/4	.44
10A	1000	T Welder	33	21	28	10.	13	1/4	.03	5/8	.30
20A	2500	Hand	48	30	36	30.	40	3/8	.11	1 1/4	1.23
20A	1500	T Welder	41	20	30	20.	27	1/4	.05	3/4	.44
40A	7000	Hand	90	36	38	60.	80	3/4	.44	2	3.14

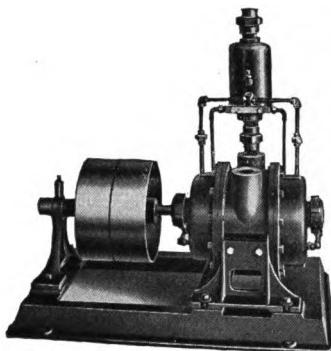
## *Rotary Air Compressors and Pumps*

### CROWELL MFG. CO.

296-298 TAAFE PLACE

BROOKLYN, N. Y.

**SOLE MANUFACTURERS, UNDER PATENTS**



Type D

#### **CROWELL ROTARY AIR COMPRESSOR OR VACUUM PUMP**

The action is *simple, positive, and durable*, with a continuous intake and delivery of the air. No valves, springs, gears, or unbalanced parts are used or required in the construction or operation of Crowell Machines.

The pressure or degree of vacuum is not dependent on high operating speeds. Floor space is small—no special foundations are required. Lubrication is positive and automatic.

Manufactured in nine standard sizes with capacities ranging from four to 390 cu. ft. of free air per minute, and designed for a working pressure of 25 lbs. or less to the sq. in.

When used as a vacuum pump, will maintain a vacuum of from 29 to 30 in.

*Air Receivers supplied when required.*

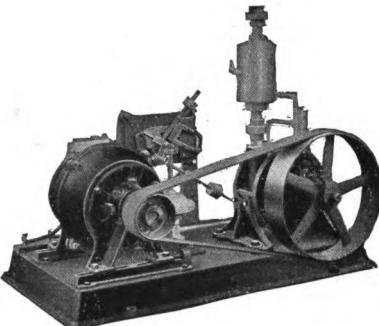
#### **CROWELL ROTARY VACUUM PUMP**

This machine was until recently used exclusively by the Paul System Co. in connection with their Patented vacuum system of steam heating, but is now available for all engineers and contractors.

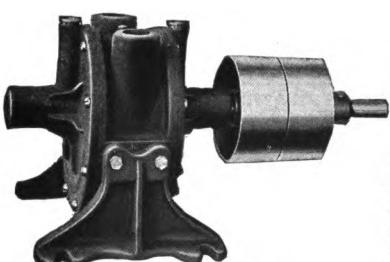
It is electrically driven by a Sprague Round Type Motor and controlled by a rubber diaphragm switch, and can be set so that it starts and stops at any desired vacuum from 1 to 10 inches, thus automatically keeping the heating lines free from air and water.

Sizes from 1 to 5, having capacities sufficient for from 4000 to 60,000 sq. ft. of radiating surface.

Equally adapted for many other purposes requiring a higher vacuum.



Type F



Type A. Sizes 1 and 2

#### **CROWELL POSITIVE PRESSURE BLOWER**

These blowers are suitable for all purposes requiring air under pressure of from 1 to 10 lbs. per sq. in. or any degree of vacuum not exceeding 24 inches.

The principle of construction is identical with that of the machines described above; an internal drum and shaft carries sliding blades which operate in close contact with the cylinder wall. *No springs, valves, gears or unbalanced parts.*

Sizes of from 7 to 390 cu. ft. of free air per minute.

**Write for Catalogue.**

## *Air Compressors*

# CHICAGO PNEUMATIC TOOL COMPANY

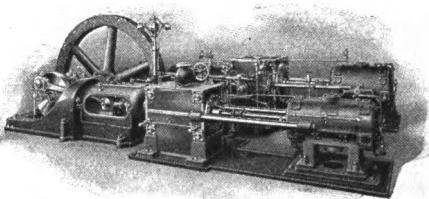
Fisher Building, CHICAGO

50 Church St., NEW YORK

**MANUFACTURERS OF AIR AND GAS COMPRESSORS FOR ALL CLASSES  
OF WORK AND OF ANY CAPACITY OR METHOD OF DRIVE**

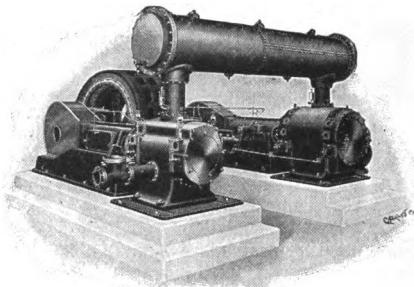
### CLASS "C":

Heavy Duty Horizontal Cross Compound or Duplex Corliss, duplex or two-stage air cylinders, for steam pressures from 80 to 200 lbs., in capacities from 1500 to 5000 cubic feet.



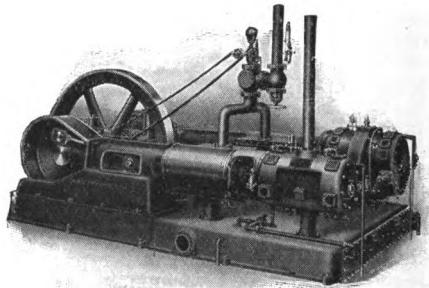
### CLASS "M-CE":

Electric Motor Driven Compressor, with motor mounted directly on compressor shaft. For any current or voltage. Duplex or two-stage air cylinders, in capacities from 550 to 4000 cubic feet.



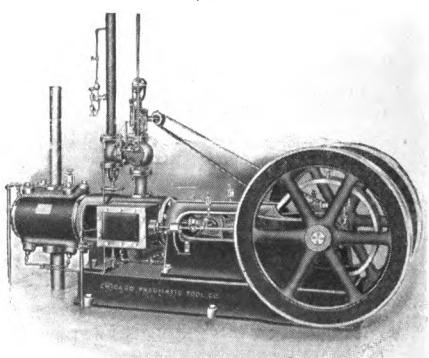
### CLASS "G"-DUPLEX:

Duplex or Compound Steam Driven Type with duplex or two-stage air cylinders, with sub-base and intercooler in same. For steam pressures from 80 to 175 lbs., and in capacities from 190 to 2100 cubic feet.



### CLASS "G"-STRAIGHT LINE:

Single Steam Single Air Cylinders in straight line, mounted on rigid frame, for steam pressures from 60 to 150 lbs., and capacities from 30 to 500 cubic feet.



Also a full line of Belt and Short Belt Driven Compressors of corresponding types and sizes. Also gasoline engine driven compressors, stationary and portable, from 70 to 150 cubic feet capacity.

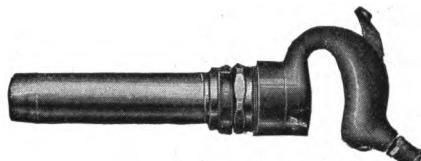
Descriptive pamphlets, specifications and prices on application to main offices or to branches in principal cities.

# CHICAGO PNEUMATIC TOOL COMPANY

Fisher Building, CHICAGO

50 Church St., NEW YORK

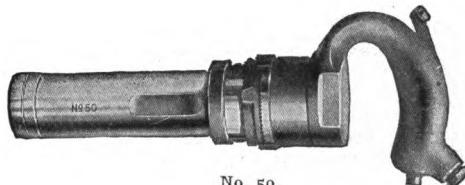
MANUFACTURERS OF PNEUMATIC HAMMERS FOR ALL PURPOSES, RIVETING,  
CHIPPING, CALKING AND CUTTING AND CARVING STONE



## BK. CHIPPING AND CALKING HAMMERS

Made in seven sizes. Stroke lengths from one inch to four inches.

Catalogues and Bulletins  
on application.



## No. 50. RIVETING HAMMER

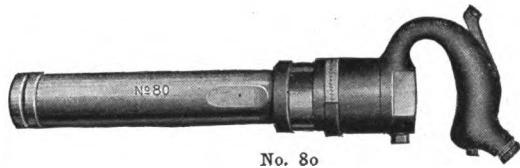
Weight 19½ lbs.; 5-inch  
stroke; capacity up to  $\frac{3}{4}$ -  
inch rivets.



## No. 60. RIVETING HAMMER

Six-inch stroke; capacity  
up to  $\frac{3}{8}$ -inch rivets.

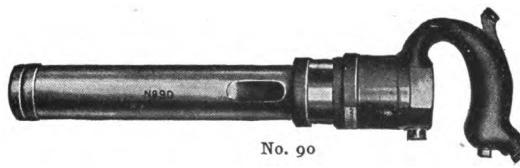
Weight { Standard....22 lbs.  
Heavy.....25 lbs.



## No. 80. RIVETING HAMMER

8-inch stroke; capacity up  
to  $1\frac{1}{2}$ -inch rivets.

Weight { Standard....24 lbs.  
Heavy.....25 lbs.  
Ex. Heavy..36 lbs.



## No. 90. RIVETING HAMMER

9-inch stroke; capacity up  
to  $1\frac{1}{4}$ -inch rivets.

Weight { Standard....25 lbs.  
Heavy.....26 lbs.  
Ex. Heavy..37 lbs.

## Pneumatic Tools

# CHICAGO PNEUMATIC TOOL COMPANY

Fisher Building, CHICAGO

50 Church St., NEW YORK

MANUFACTURERS OF PORTABLE ELECTRIC TOOLS, DRILLS, GRINDERS AND HOISTS FOR OPERATING ON DIRECT OR ALTERNATING CURRENT.



Size No. 2 S-S. Capacity  $\frac{1}{8}$  inch in metal

### UNIVERSAL ELECTRIC DRILLS

Operating on either direct or alternating current interchangeably.

Size	Inch
No. 000.	Capacity in metal $\frac{1}{16}$
No. 000x.	Capacity in metal $\frac{1}{4}$
No. 00.	Capacity in metal $\frac{1}{16}$
No. 0.	Capacity in metal $\frac{3}{8}$
No. 1.	Capacity in metal $\frac{1}{2}$
No. 2.	Capacity in metal $\frac{7}{8}$
No. 3.	Capacity in metal $1\frac{1}{4}$
No. 4.	Capacity in metal 2

### HEAVY DUTY DIRECT CURRENT ELECTRIC DRILLS

For 110 and 220 volts.

Built in five sizes as follows:

Size	Inch
No. 0.	Capacity in metal $\frac{3}{8}$
No. 1.	Capacity in metal $\frac{1}{2}$
No. 2.	Capacity in metal $\frac{7}{8}$
No. 3.	Capacity in metal $1\frac{1}{4}$
No. 4.	Capacity in metal 2

The No. 3 and No. 4 sizes can be furnished in the center spindle as well as the side spindle style.



Style No. 4 C-S

### HEAVY DUTY ALTERNATING CURRENT ELECTRIC DRILLS

For two and three phase.

Built in five sizes as follows:

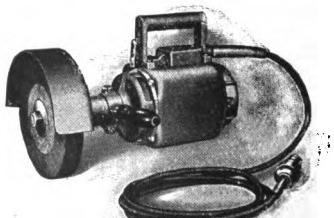
Size No. 0.	Capacity in metal $\frac{3}{8}$ inch.
Size No. 1.	Capacity in metal $\frac{1}{2}$ inch.
Size No. 2.	Capacity in metal $\frac{7}{8}$ inch.
Size No. 3.	Capacity in metal $1\frac{1}{4}$ inch.
Size No. 4.	Capacity in metal 2 inch.

Furnished in the side spindle style only. Standard windings are for 60 cycles, 110 or 220 volts. Sizes Nos. 2, 3 and 4 can be wound for 440 volts.

### ELECTRIC GRINDERS

For use in the foundry, machine and structural shop. Built in two sizes for 110-220-600 volts direct current, and 110-220 volts two or three phase alternating current.

Size No. 5 BP carries  $5\frac{3}{4}$  inch wheel.  
Size No. 8 BP carries  $6\frac{1}{4}$  inch wheel.



Size No. 8 BP Portable Grinder

Bulletins on application.

## CHICAGO PNEUMATIC TOOL COMPANY

Fisher Building, CHICAGO

50 Church St., NEW YORK

MANUFACTURERS OF IMPROVED BALL BEARING DRILLS OF ALL TYPES, FOR ALL CLASSES OF WORK WITHIN THE SCOPE OF A PORTABLE DRILL.

### 10F LITTLE GIANT MIDGET DRILL

The ideal drill for drilling tell-tale holes in stay-bolts and keeping them open.

Speed, light, 2400 R.P.M. Weight, 8 lbs.



### IMPROVED LITTLE GIANT BALL BEARING DRILLS

Size 1  
Speed, 340 R.P.M.  
Weight, 58 lbs.  
Capacity, 4 Morse Taper.

Size 2  
Speed, 450 R.P.M.  
Weight, 41 lbs.  
Capacity, 3 Morse Taper.

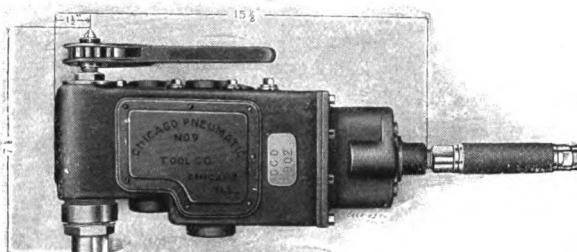
Size 4  
Speed, 700 R.P.M.  
Weight, 22½ lbs.  
Capacity 2 Morse Taper.



### LITTLE GIANT CLOSE QUARTER DRILLS

Size 8  
Speed, 270 R.P.M.  
Weight, 38 lbs.  
Capacity, 3 Morse Taper.

Size 9  
Speed, 135 R.P.M.  
Weight, 38 lbs.  
Capacity, 4 Morse Taper.



### No. 4 IMPROVED LITTLE GIANT GRINDER

As will be seen from the cut, the grip handle is provided with a trigger which when pressed down opens the throttle, and is held in that position until released by pressing a button at the side.

Speed 3000 R.P.M. Capacity, 8" x 1" Emery wheel.

Catalogues and Bulletins on request



## Air Compressors

# INGERSOLL-RAND COMPANY

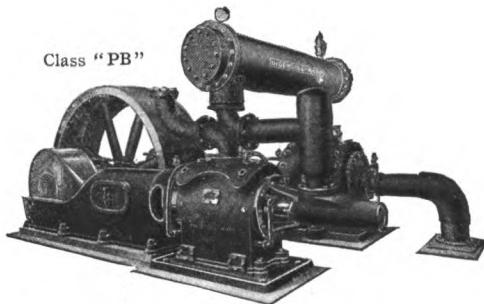
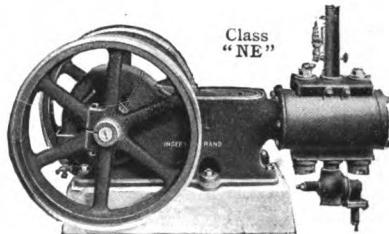
11 BROADWAY, NEW YORK, U. S. A.

Offices in all Principal Cities of the World

**BUILDERS OF AIR AND GAS COMPRESSORS, PNEUMATIC HAMMERS, PNEUMATIC DRILLS, AIR MOTOR HOISTS, AIR MOTORS, PNEUMATIC SAND RAMMERS, AIR LIFT PUMPS, AIR POWER MACHINERY OF ALL KINDS**

### POWER DRIVEN COMPRESSORS

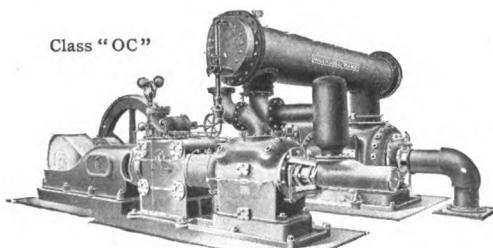
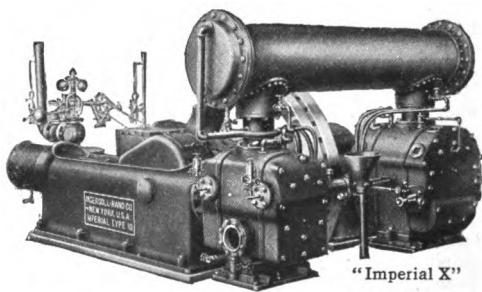
Ingersoll-Rand types in this series provide for drive by gear, silent chain, belt, rope, or direct shaft connection to electric motor or water wheel. Straight line and duplex units are offered—single stage, two stage, or multi-stage.



In each type details of design and construction have been carefully worked out to secure the best efficiency consistent with the size and style of unit, and the utmost wearing quality. Capacities in various types, 4 to 5700 cu. ft. per minute; all pressures up to 3000 lbs.

### STEAM DRIVEN COMPRESSORS

In this series are machines with plain slide valve, balanced Meyer adjustable cut-off valve, and drop-release Corliss valve. In straight line types simple steam cylinders are used. Duplex types have duplex simple or cross-compound steam cylinders, condensing or non-condensing.



Every refinement consistent with type and size has been employed to make the largest volume of compressed air per hundred lbs. of steam used—permanent economy being the ideal sought. Capacities in various types, 96 to 8000 cu. ft. per minute; all pressures up to 3000 lbs.

Descriptive Bulletins on Request

## INGERSOLL-RAND COMPANY

### "CROWN" AND "IMPERIAL" PNEUMATIC HAMMERS

Ingersoll-Rand Hammers for chipping, riveting, caulking, scaling, etc., are made in a complete range of sizes and in two distinct types, meeting every condition. The Company maintains its regular standard in this line, as representative of the quality of the complete Ingersoll-Rand line.

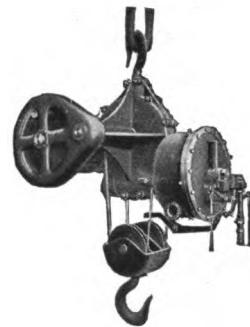


### "LITTLE DAVID" PNEUMATIC DRILL

This is a new machine, built and sold on the following basis:—It has only two-thirds as many parts as any other drill—does more work per unit of power than any other—requires less attention and costs less for repairs than any other. All standard sizes and types.

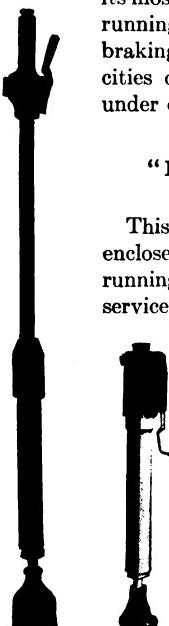
### "IMPERIAL" AIR MOTOR HOISTS

The hoisting problem—handling work and materials in shop, foundry, warehouse, factory—finds its most economical solution in this silent-running, self-oiling, wholly-enclosed, self-braking hoist. The five sizes have capacities of  $\frac{1}{2}$ , 1, 2,  $3\frac{1}{2}$  and 5 tons, working under ordinary pressures.



### "IMPERIAL" AIR MOTORS (Not Illustrated)

This is a high-grade 3-cylinder wholly-enclosed motor splendidly adapted for running grinders, small tools, small cranes, or other light intermittent service. Two sizes give 2 and  $3\frac{1}{4}$  H. P.



### "CROWN" SAND RAMMERS

Experience all over the country has demonstrated that improved castings, larger output, and lower castings cost result from the adoption of "Crown" Pneumatic Rammers in the foundry. And they are built to withstand the hard conditions of foundry service. Both floor and bench types can be had. This machine has also proved useful in ramming concrete in construction work.

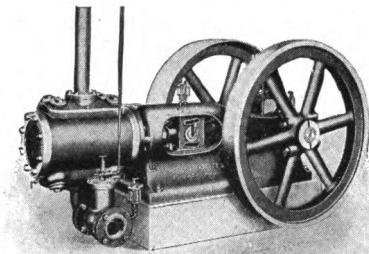
Descriptive Bulletins on Request

## THOS. H. DALLETT CO.

YORK AND 23d STS.,

PHILADELPHIA, PA.

**MANUFACTURERS OF AIR COMPRESSORS, PNEUMATIC STONE-WORKING TOOLS, BOILER SCALERS, WOOD CARVING TOOLS, ETC.**



Straight Line—Belt Driven

"Dallett" Compressors are made in straight-line, duplex and compound types, belt, steam and motor driven, their characteristics adapting them for any service where the requirements call for a combination of economy, high efficiency, ease of operation and maintenance.

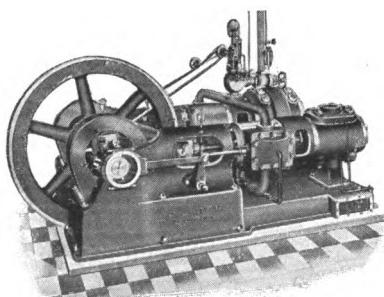
The standard machines range in capacities from 79 cu. ft. per minute up; all types being compact and massive in construction, with large bearing surfaces, producing a machine of strength, reliability and efficiency.

Frames are of the open fork, center-crank type, with a large amount of metal under the main bearings, and all parts requiring adjustment are easily accessible.

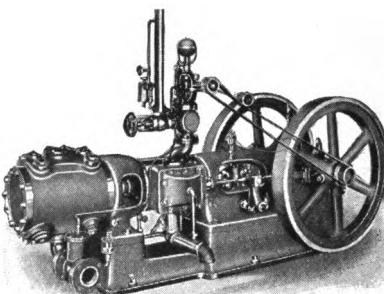
All air and steam cylinders are adapted for pressures up to 125 lbs., the steam valves being of the plain D slide valve type, but on the larger machines the Meyer Adjustable Balanced Cut-off Valve is used where specified.

All air cylinders are equipped with the "Dallett" Silent Inlet and Discharge Valves, these being of the Poppet type, allowing a full intake and discharge of air to the capacity of the cylinder at each stroke of the piston.

The steam passages are direct; air passages and valve ports are of ample area, combined with large water-cooling surfaces and thorough and efficient lubrication, and losses by clearance and leakage have been reduced to minimum.



Duplex—Steam Driven—Two-Stage Air



Straight Line—Steam Driven

All machines are equipped with automatic controlling and unloading devices. Compound machines with two-stage air cylinders are furnished with inter-cooler of large cooling surface, employing the return flow type of water circulation.

All ratings have been conservatively made, and every machine is given an exhaustive test above rated load before leaving the shop.

**WRITE FOR BULLETINS.**

## LAIDLAW-DUNN-GORDON COMPANY

115 BROADWAY, NEW YORK

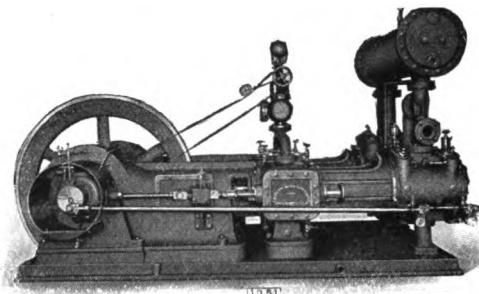
WORKS: Cincinnati, Ohio.

Branch Offices in all Principal Cities

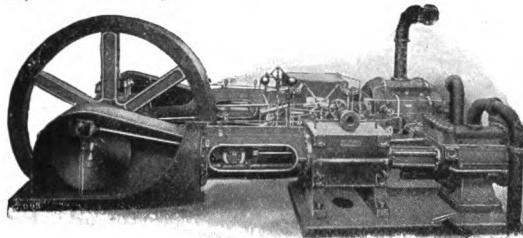
**AIR COMPRESSORS, VACUUM PUMPS, HIGH DUTY PUMPING ENGINES**

### AIR COMPRESSORS.

300 to 10,000 cu. ft. per minute. 10 to 5000-lbs. air pressure. Our highly developed production system both in Foundry and Machine Shop, together with careful standardization and interchangeability of parts, permits our giving to our clients the highest obtainable value for their money. Our Cincinnati Air Valve Gear as continuously developed and improved by us, has set the pace in the



Meyer Gear Air Compressor

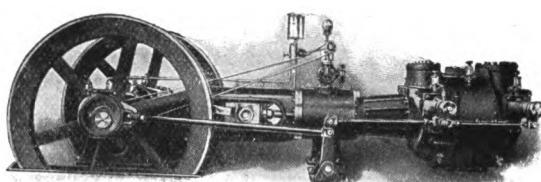


Corliss Air Compressor

air compressor business for this country for ten years, and permits our giving to our clients the highest obtainable efficiency. Both value and efficiency, as well as the nature of our service to our clients, are attested by the highest proportion of repeat orders received by any builder in the compressor business.

Bulletin L521-68A describes our compressor line in condensed form.

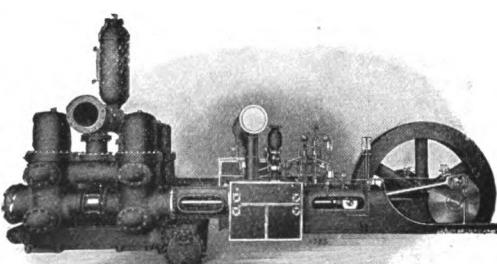
**VACUUM PUMPS.** Our close clearance high efficiency rotary dry vacuum pump serves four out of five of the largest turbine plants in the country. Our gear is so designed that continued use improves efficiency. We have no flash ports.



Vacuum Pump

**HIGH DUTY PUMPING ENGINES.** One million to twelve million gallons capacity. We are replacing direct acting plants of the older type, in large numbers, with high duty installations, operating on one-third to one-half of the previous fuel expenditure.

Our business policy is based on the effort to so completely satisfy a client, as to insure our receiving his next order.



High Duty Pumping Engine

L 172.8

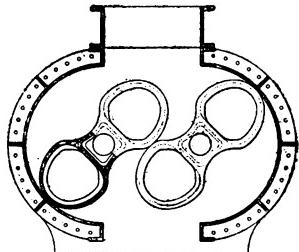
## *Blowers and Exhausters*

### P. H. & F. M. ROOTS COMPANY

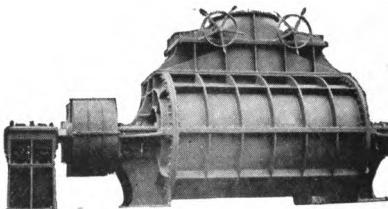
CONNERSVILLE, INDIANA

ROTARY BLOWERS, GAS EXHAUSTERS, ROTARY PUMPS FLEXIBLE ROPE COUPLINGS

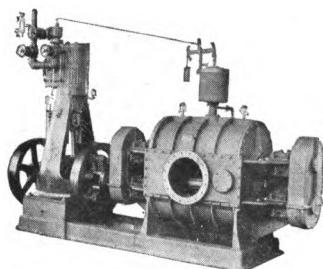
#### ROOTS' BLOWERS



Sectional View Showing Interior Construction



Double Outboard Bearing, Single Geared Smelting Blower with Double Acting Quick Opening Blast Gate



Engine Driven Gas Exhauster  
The general construction is the same as

#### FACILITIES

**SIZE.**—Our facilities are such that we can build Blowers up to sixty-inch gear machines, having a displacement of over seven hundred cubic feet per minute.

**ACCURACY.**—By the use of machines specially made for our work, we insure accuracy, which results in high efficiency, not once, but in all machines.

**CAPACITY.**—Is the largest of any Positive Blower Company in the world.

#### SPECIAL MACHINES

We build special machines for handling gases. They can be bronze or lead lined, with or without stuffing boxes. The general construction is the same as Smelting or High Pressure Blowers.

#### GAS EXHAUSTERS

The Roots' Exhauster as built today, is the nearest approach to a perfect Rotary machine. It is strong throughout, without being cumbersome, work manlike in appearance, without sacrificing strength and durability to finish, easy to adjust, and has all adjustments in places easy of access, without removing one part to get at another.

#### TABLE OF SIZES, POWERS, AND CAPACITIES OF ROOTS' GAS EXHAUSTERS

No. of Exhauster	Suction and Discharge Diameters	Horse Power at Stated Speed and One Pound Pressure	Speed of Exhauster	Displacement in Cubic Feet per Revolution	Capacity per Hour in Cubic Feet No Allowance for Shrinkage
2	4	.75	200	.91	10,920
3	6	1.5	200	1.31	15,720
4	8	2.5	180	2.95	31,880
5	10	3.75	170	4.8	48,960
6	12	5.	160	8.3	79,880
7	16	7.50	150	13.1	117,900
8	16	11.	140	19.6	164,840
8½	20	15.5	130	28.2	219,960
9	20	19.	120	38.5	277,200
9½	20	24.	110	51.2	337,920
10	24	29.	100	61.75	370,500
10½	30	36.	95	81.	461,700
11	30	50.	90	111.2	600,480
11½	36	69.	90	147.9	798,680
12	36	80.	85	192.	979,200
12½	42	102.	85	244.	1,244,400
14	42	115.	80	304.9	1,463,520

# P. H. & F. M. ROOTS COMPANY

## ROOTS ROTARY PUMPS

The range of operation of these Pumps is from ten feet to two hundred feet head and for handling any liquid substance, not containing grit, with economy ranging from 75 per cent to 85 per cent of the power applied to the Pump shaft.

The source of power may be turbine, steam or motor, and any of these classes of power may be direct connected, geared or belt driven, thus giving a wide choice of arrangement and allowing the Pump to be used under almost any conditions.

Irrigation reservoir, condenser, cooling towers, circulating work for hot or cold water or brine, are a few among the many purposes to which the Pumps are successfully applied. The sizes range from the 50,000 gallons a minute irrigation pump, running 70 r.p.m., to the small 1-10 gallon displacement per revolution Pump, running 600 r.p.m.

For handling oil, tar or ammonia, these pumps are well suited. Special lining and impellers may be used where the liquids to be pumped would attack cast iron.

Briefly, the operation of the Pumps is as follows: The revolution of the shafts and impellers traps the water between the lobes and the case, delivers it to the discharge side, where the rolling together of the impellers on the center lines of the shaft prevents the return of the water.

The care and workmanship with which the impellers are fitted to each other and to the case assure a small slip of water both at the rolling and case contacts. The suction air chambers cast on the lower half of the half circles save unsightly pipe connections, at the same time stiffening the Pump as a whole.

The flow of water is steady and uniform, and unless air enters the suction pipe, free from pulsation.

### FLEXIBLE ROPE COUPLINGS

This coupling was designed to meet a condition in rotary pump work, and proved so satisfactory for this work that it is now used on a large percentage of our direct connected Blowers, Exhausters and Pumps. The points of advantage that place it ahead of other designs for the same purpose are these:

**FIRST**—It corrects for misalignment in any direction, whether due to settling of foundations, wear of engine bearings, or original setting, thus saving uneven wear and heating.

**SECOND**—It takes care of end thrust caused by heating, wear of bearings or oscillations of the driving mechanism.

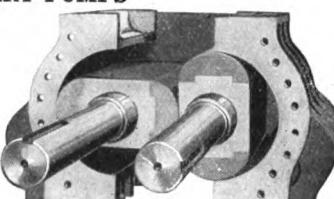
**THIRD**—It eases up sudden fluctuations of load by the swing of the loop.

**FOURTH**—It permits rotation in either direction, with equal results and symmetrical positions.

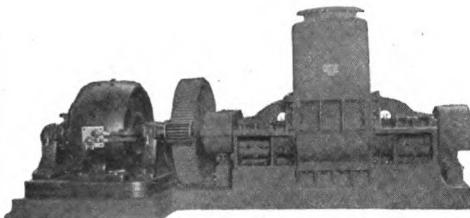
**FIFTH**—The ropes can be removed as quickly as the bolts in a solid coupling can be taken out.

**SIXTH**—With ropes off, either the driving or driven machine can be rotated without interference.

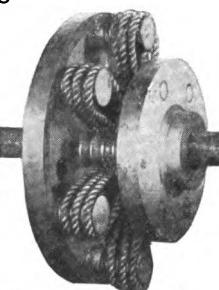
**SEVENTH**—The life of the ropes is long and can be renewed at small expense.



Interior Construction of Rotary Pump



Direct Connected Motor and Pump



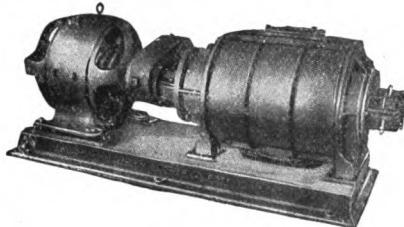
## Blowers and Exhausters

# WILBRAHAM-GREEN BLOWER CO. POTTSTOWN, PA.

MANUFACTURERS OF THE "WILBRAHAM-GREEN" ROTARY POSITIVE PRESSURE BLOWER AND GAS EXHAUSTER. KNOWN EVERYWHERE AS "THE OLD RELIABLE." SUITABLE FOR EITHER LOW OR HIGH PRESSURES. HIGH PRESSURE MACHINES ARE, HOWEVER, USUALLY DESIGNED TO SUIT THE PARTICULAR WORK THEY ARE TO PERFORM.

A few of the lines of work for which our Blowers and Gas Exhausters are especially adapted and have been used during the last 40 years: Smelters, Pneumatic Tubes, Oil Burning, Foundry Cupolas, Paper Mills, Vacuum Pumps, Oil Refineries and Gas Works.

The internal construction of Blowers and Gas Exhausters is very similar.



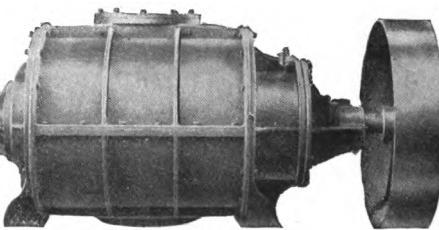
**Motor Driven Blower**

Shafts are FORGED STEEL.

Our design allows the driving pulley or gear to be placed against the end of the Bearing, reducing the overhang to a minimum. This is a very IMPORTANT feature, in either a Pulley or Motor Driven unit.

Gears are accurately cut from the solid and very wide face.

Blowers or Exhausters are built with pipe connections either top or bottom or on the sides, to suit conditions.

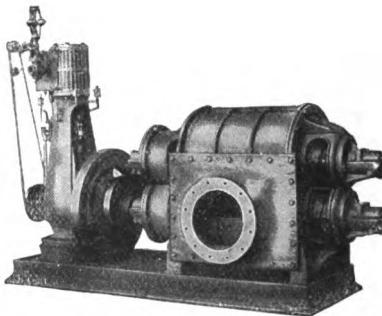


**Pulley Driven Blower**

Low pressure machines are usually single-gearied.

High pressure machines are usually double-gearied.

Bearings are bushed with Phosphor Bronze; are Ring Oiling, and very large, so that the pressure per inch square of projected area is extremely low.



**Engine Driven Exhauster**

### Regular Pulley-Driven Blowers. Approximate Dimensions in Inches

No.	Displace- ment per Revolution Cubic Feet	Total Length	Vertical Blower Side Outlet		Horizontal Blower Top or Bottom Outlet			PULLEY		Average Shipping Weight
			Total Height	Face to Face of Flanges	Total Height	Face to Face of Flanges	Total Width	Diameter	Face	
1	3	50	31	23	24	23	30	20	5	1,525
2	5½	67	31	23	24	23	30	24	6	2,100
3	8	70	36	26	27	26	36	30	6	2,800
4	13	78	42	29	30	29	40	32	7	3,800
5	19	87	47	34	34	34	46	40	8	4,800
5A	22	99	48	34	36	34	47	40	9	5,700
5B	25	107	48	34	36	34	47	42	9	6,100
6	29	100	56	41	40	41	55	44	10	7,800
6A	35	110	58	42	43	42	57	48	10½	9,500
6B	45	120	63	44	45	44	62	48	12	11,400
7A	55	130	70	48	48	48	67	54	12	15,500
7B	67	124	80	60	61	60	81	60	15	17,500
7½	85	144	80	60	61	60	81	66	15	19,000
8	112	154	90	64	66	64	89	72	18	32,000

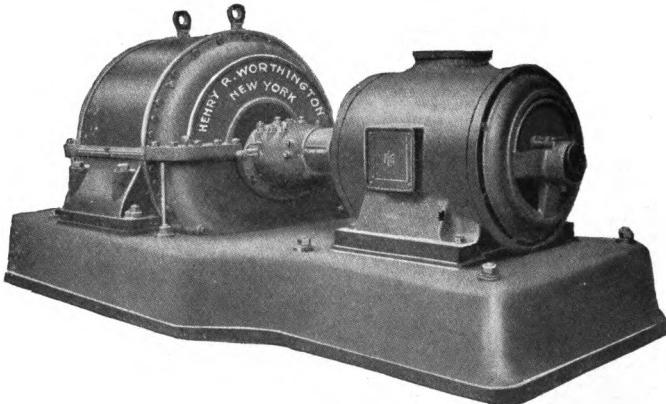
Larger Sizes Built to Order

**HENRY R. WORTHINGTON**  
115 BROADWAY, NEW YORK      WORKS: HARRISON, N. J.

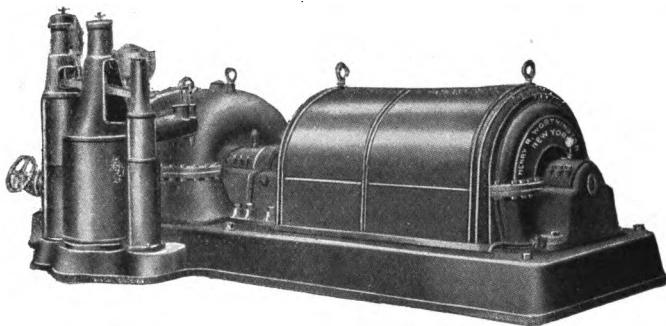
## **Manufacturers of**

Turbine Driven { TURBO-BLOWERS  
and  
Motor Driven { TURBO-COMPRESSORS

**For every pressure and capacity**



**Motor Driven Turbo-Blower—Capacity 30,000 cu. ft. per min.** 15 lbs. gage pressure



Turbo-Compressor driven by Mixed Pressure Turbine  
Capacity 10,000 cu. ft. per min. 100 lbs. gage pressure

After careful investigation the Worthington Company have acquired the exclusive rights for the manufacture and sale on the American continent and in the Hawaiian and Philippine Islands, of the full line of Turbo Compressors and Blowers so successfully developed by Messrs. Pokorny & Wittekind, of Frankfort, a.m., Germany,—and are in position to build and supply Turbo Compressors and Blowers for all ranges in capacity and pressure ordinarily covered by reciprocating machines.

Purchasers may be assured that this line of Compressors has absolutely passed beyond the experimental stage. It has produced the highest economy ever attained and has thoroughly demonstrated that it is the most practical and reliable apparatus of its type now in the market.

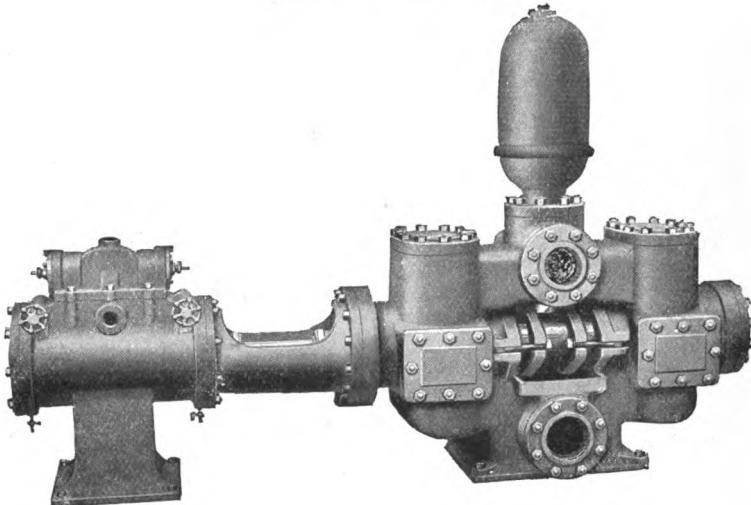
Full information and estimates will be furnished promptly.

W 206 S

**AMERICAN STEAM PUMP COMPANY**  
BATTLE CREEK, MICH.

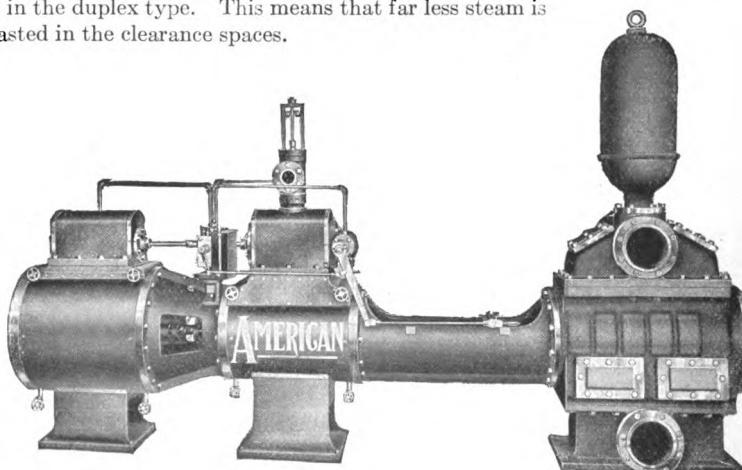
**STEAM AND POWER PUMPING MACHINERY**

**MARSH STEAM PUMPS AND AIR COMPRESSORS, AMERICAN SIMPLE AND COMPOUND PUMPS, AMERICAN POWER PUMPS AND AIR COMPRESSORS.**



Marsh and American Steam Pumps are of the "Simplex Type" and offer the following advantages over the "Duplex" type built by other manufacturers:

- (a) Having fewer parts they are less liable to break-down.
- (b) Making only half as many strokes and stops they waste less steam.
- (c) Having only two steam ports as compared with eight in a duplex pump less steam is wasted in the ports.
- (d) They have only two clearance spaces as compared with four in the duplex pump, and the full length of stroke is always assured, instead of being variable as in the duplex type. This means that far less steam is wasted in the clearance spaces.



# AMERICAN STEAM PUMP COMPANY

BATTLE CREEK, MICH.

OUR LATEST CATALOGUE NO. 18 CONTAINS NEARLY 200 PAGES OF ILLUSTRATIONS,  
DESCRIPTION, AND WORKING DATA COVERING:

## MARSH PUMPS

Air and Circulating Pumps	High Service Pumps
Air and Feed Pumps	Hydraulic Pressure Pumps
Air Compressors	Hydraulic Pumps
Air Lift Pumping	Magma Pumps
Air Pumps (vac.)	Marine Pumps
Automatic Feed Pumps and Receivers	Milk Pumps
Automobile Pumps	Model Pump
Beer Pumps	Naphtha Pumps
Boiler Feed Pumps	Oil Pump, Special
Brine Pumps	Plunger Pumps, Outside Packed
Combined Air and Circulating Pumps	Power Milk Pumps
Combined Air and Feed Pumps	Pumping Outfits
Condensers, Jet	Pump Stands
Condensers, Surface	Receiver Pumps
Creamery Pumps	Sinking Pumps
Deep Well Pumping Engines	Sugar House Pumps
Directions	Sweet Water Pumps
Drip Pans	Tank Pumps
Dry Vacuum Pumps	Traction Engine Pumps
Filter Press Pumps	Vacuum Pumps
Fire Pumps	Vacuum Pan Pumps
General Service Pumps	Water Cylinders, Deep Well
	Yacht Pumps

## AMERICAN PUMPS

Air Compressors, Power	Heavy Service, Geared
Heavy Service, Belted	Light Service, Belted
Light Service, Belted	Light Service, Geared
Motor Driven	Motor Driven
Air Compressors, Steam	Simple Pumps
Compound Pumps	Piston, Heavy Service, Short Stroke
Piston, Heavy Service	Piston, Heavy Service, Long Stroke
Piston, Light Service	Piston, Heavy Service, Special
Plunger, Outside Center Packed	Piston, Light Service, Short Stroke
Power Pumps	Piston, Light Service, Long Stroke
Heavy Service, Belted	Plunger, Outside Center Packed

New York Office, Whitehall Building, 17 Battery Place

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Representatives in all the principal cities throughout the world.

## ADVANCE PUMP & COMPRESSOR CO.

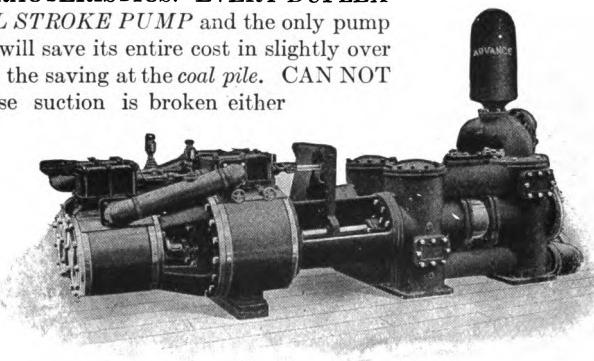
BATTLE CREEK, MICH.

### MONEY SAVING PUMPING MACHINERY ONLY

DUPLEX STEAM PUMPS. ELECTRIC-DRIVEN POWER PUMPS. HIGHLY EFFICIENT CENTRIFUGAL PUMPING MACHINERY OF EVERY DESCRIPTION. VACUUM PUMPS.

SPECIAL CHARACTERISTICS. EVERY DUPLEX PUMP IS A FULL STROKE PUMP and the only pump of this type which will save its entire cost in slightly over one year's time, by the saving at the *coal pile*. CAN NOT RUN AWAY in case suction is broken either with or without load.

OUR VALVE MOTION is of special construction, insuring LONG LIFE to this part of the pump which for years has been the chief trouble with duplex pumps.



ADVANCE PUMPING MACHINERY ALWAYS MAKES GOOD—NO EXPERIMENTS—NO LOSSES—NO REGRETS.



ASK FOR  
OUR NEW  
CATALOG

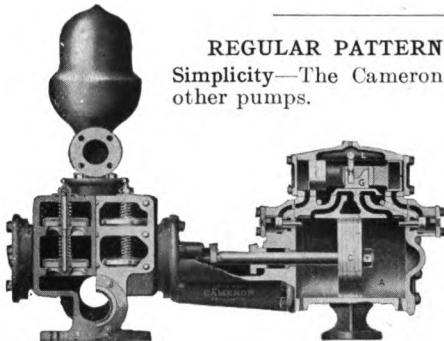
BRING  
US YOUR  
PUMP  
TROUBLES

Advance Centrifugal Pump Throwing 2800 Gallons Per Minute for Irrigation

# A. S. CAMERON STEAM PUMP WORKS

NEW YORK, N. Y.

DESIGNERS AND BUILDERS OF SIMPLEX AND COMPOUND PISTON AND PLUNGER PUMPS HORIZONTAL AND VERTICAL; BOILER FEED PUMPS; FIRE PUMPS; OIL LINE PUMPS; MINE PUMPS; STATION PUMPS; SINKING PUMPS; MARINE PUMPS; PRESSURE PUMPS; AIR PUMPS; VACUUM PUMPS; SUCTION AND JET CONDENSERS.



Sectional View of Cameron Regular Pattern Piston Pump.

**REGULAR PATTERN FOR GENERAL SERVICE.**  
Simplicity—The Cameron has fewer working parts than other pumps.

**Durability** — The steam mechanism consists of four stout pieces only. None of these parts are delicate, intricate or exposed to hazard or possible injury.

When under full steam pressure the suction is lowered or lost, the Cameron can be operated at full speed with less damage or danger of the piston striking the cylinder heads than any other pumps on the market.

**No Outside Valve Gear**—The steam valve movement works in line with the piston rod without the intervention of arms or levers. There are no rods to become bent, broken or get out of alignment, no tappet bars, rollers or clamps to adjust. Therefore, the Cameron can be run at a higher speed than other pumps with less danger, yet increased capacity.

**Stroke**—A Cameron Pump will not reverse until it has completed its full stroke.

**Wear**—Every Cameron Pump is packed to compensate for wear.

**Maintenance and Repairs**—The Cameron will give the maximum of capacity and service with the minimum cost of maintenance and repairs.

## DIMENSIONS AND CAPACITY OF CAMERON REGULAR PATTERN PISTON PUMPS FOR GENERAL SERVICE

Size Number	Diameter of Steam Cylinder, Inches	Diameter of Water Cylinder, Inches	Stroke of Piston Inches	Capacity per Stroke Gallons	Capacity at Ordinary Speed per Minute Gallons	Steam Pipe	Exhaust Pipe	Suction Pipe	Discharge Pipe	Floor Space Inches	Weight
0	3½	2	4	.054	8	3½	1½	1¼	1	32 x 9	136
1	4	2	6	.081	12	3½	1½	1¾	1	40 x 10	210
2	5	2½	6	.12	18	1½	3½	1½	1½	40 x 11	260
3	6	3	7	.21	28	3½	1	2½	2	47 x 13	418
3a	6	3½	7	.29	38	3½	1	2½	2	47 x 15	435
4	7	3½	7	.29	38	3½	1	2½	2	47 x 15	459
4a	7	4	7	.39	50	3½	1	2½	2	51 x 16	457
5	7	3½	12	.5	50	1	1½	3	2½	58 x 17	820
5b	7	5	13	1.10	100	1	1½	4	3	63 x 20	1117
6	8	4	12	.65	65	1	1½	3	2½	58 x 18	864
6a	8	5	13	1.10	100	1	1½	4	3	63 x 20	1160
7	10	5	13	1.10	100	1½	2	4	3	64 x 21	1345
8	10	6	13	1.59	150	1½	2	4	3	64 x 21	1411
9	12	7	13	2.16	200	1½	2½	5	4	66 x 24	1928
10a	14	8	13	2.83	261	2	3	5	5	73 x 26	2548
10	14	9	18	4.96	330	2	3	6	5	81 x 30	3126
11	16	10½	18	6.75	450	2½	4	8	6	90 x 37	4920
12	18	12	20	9.80	587	3	4	10	8	103 x 41	6080

## Pumping Machinery

### THE DEMING COMPANY

SALEM, OHIO, U. S. A.

NEW YORK OFFICE AND STOCK : 152 CHAMBERS STREET

SINGLE AND DOUBLE ACTING TRIPLEX PUMPS: ARTESIAN WELL PUMPS,  
FOR OPERATION BY ELECTRIC MOTORS, GAS OR GASOLINE ENGINES, OR BELT  
FROM SHAFT.

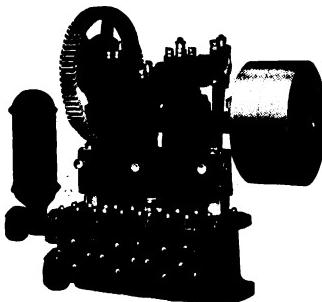


Fig. 50, Size 7 x 8 to 8 1/2 x 8.

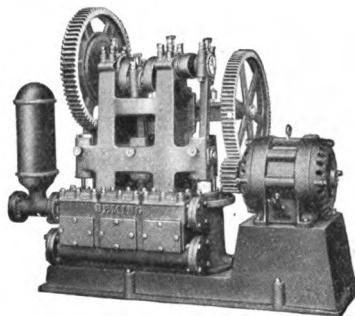


Fig. 50, Size 8 1/2 x 8 with Type "B" Drive.  
FIG. 50, STANDARD SIZES, CAPACITIES, ETC.

PLUNGERS		CAPACITY			Maximum Working Pressure Pounds	DIAM. OF PIPES		Gear Ratio	Tight and Loose Pulleys
Diam. Inches	Strok. In.	Gallons per Rev.	Usual Revs. per Min.	Gallons per Min.		Suction Inches	Disch. Inches		
2	2	.081	70	5.67	150	1 1/2	1	5 to 1	8 x 2
2 1/2	2	.127	70	8.89	150	1 1/2	1	5 to 1	10 x 2
2 1/2	3	.19	60	11.4	150	2	1 1/2	5 to 1	12 x 3
3	3	.27	60	16.2	150	2	1 1/2	5 to 1	14 x 3
3 1/2	3	.37	60	22.	150	2	1 1/2	5 to 1	16 x 3
3 1/2	4	.50	60	30.	150	2 1/2	2	5 to 1	16 x 4
4	4	.65	60	39.	150	2 1/2	2	5 to 1	18 x 4
4	6	.98	60	59.	160	2 1/2	2	5 to 1	20 x 5
4 1/2	6	1.24	60	74.	150	3	2 1/2	5 to 1	20 x 5
5	6	1.53	60	9.	150	3	2 1/2	5 to 1	24 x 5
5 1/2	8	2.46	60	147.	150	4	3	5 to 1	28 x 6
6	8	2.94	55	161.	140	4	3	5 to 1	30 x 6
7	8	4.00	55	220.	150	5	4	5 to 1	30 x 8
8	8	5.22	55	287.	150	5	4	5 to 1	36 x 8
8 1/2	8	5.90	55	324.	140	6	5	5 to 1	36 x 8
9	10	8.26	50	413.	160	8	6	5 to 1	42 x 10
10	10	10.20	45	459.	150	8	6	5 to 1	42 x 12
12	12	17.62	42	740.	150	10	8	5 to 1	48 x 16
13	14	24.10	40	964.	140	12	10	5 to 1	48 x 20

FIG. 62, CAPACITIES.



Fig. 324  
Artesian  
Well  
Cylinder

Diam. and Stroke of Cylinder	CAPACITY		†Max. Depth of Well, Feet
	Usual Revs. per Min.	Gallons per Min.	
2 3/4 x 10	40	10.2	300
2 3/4 x 16	35	14.3	300
2 3/4 x 24	28	17.2	350
3 1/4 x 10	40	19.1	175
3 1/4 x 16	35	26.7	175
3 1/4 x 24	28	32.1	190
4 1/4 x 10	40	24.5	130
4 1/4 x 16	35	42.9	100
4 1/4 x 24	28	51.5	120
5 1/4 x 16	35	62.9	70
5 1/4 x 24	28	75.4	80
6 1/4 x 24	28	104.0	60
7 1/4 x 24	28	137.2	45

† Refers to a vertical distance from surface of water to point of delivery.

Larger sizes and capacities. Complete data upon application.  
Complete 192-page Power Pump Catalog mailed on request.

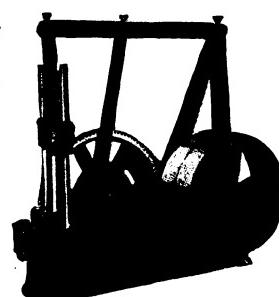


Fig. 62, 10-inch Stroke.

## D'OLIER CENTRIFUGAL PUMP AND MACHINE COMPANY

GLENWOOD AVE. AND 16TH STREET,  
PHILADELPHIA, PENNA.

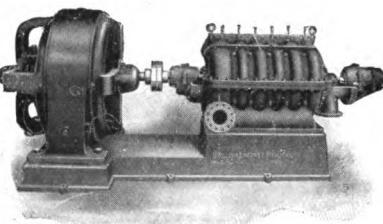
### D'OLIER CENTRIFUGAL VOLUTE AND TURBINE PUMPS

FOR WATER WORKS AND IRRIGATION, FIRE SERVICE, BOILER FEED, MINE DRAINAGE, CONDENSER SUPPLY, SEWAGE, FILTRATION SYSTEMS, HYDRAULIC MINING, AND GENERAL SERVICE.

Pumps carefully designed and built for particular service required.

Complete Pumping and Power Plants installed.

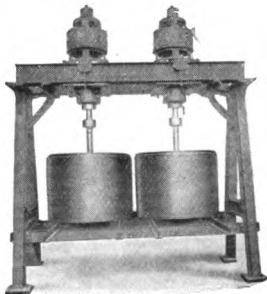
We manufacture only a high grade, high efficiency pump, using the best grade of materials throughout. The impellers are accurately designed and carefully finished, thereby insuring maximum efficiency.



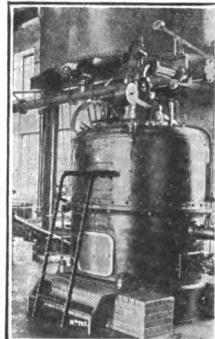
6-6 Stage D'Olier Turbine Pump. 700 G. P. M.  
at 700 ft. total head.

### D'OLIER CENTRIFUGAL MACHINES

For sugar, chemicals, sewage, oil and waste, reclaiming, clarifying and filtering and textile work. Belted, electric motor or steam turbine driven.



**STANDARD ELECTRIC CENTRIFUGALS,**  
2 in. battery on framing, making a self-contained unit. For sugar work, chemicals, etc. A strictly high grade machine of rugged construction; capable of results vastly superior than obtained from the belted or water driven machines formerly used.



**SLUDGE CENTRIFUGALS** for the drying of sludge emanating from town sewage. The only successful continuously operating machine. Successfully used abroad and being now introduced in America. We are sole representatives and will be pleased to confer with and submit further data to interested engineers.

We make a specialty of the design and manufacture of special centrifugal machines, especially those for extreme high speeds.

Send for Catalogue.

# THE GOULDS MANUFACTURING CO.

SENECA FALLS, N. Y.

EFFICIENT TRIPLEX AND CENTRIFUGAL POWER PUMPS  
FOR EVERY SERVICE

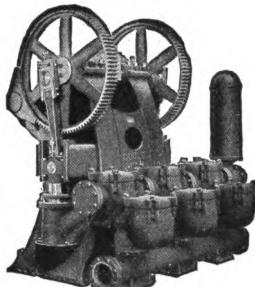


Figure 1283

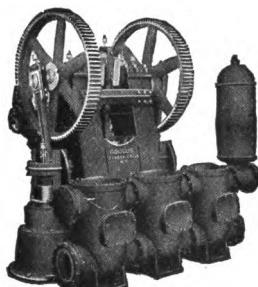


Figure 920

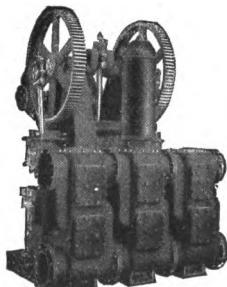


Figure 1364

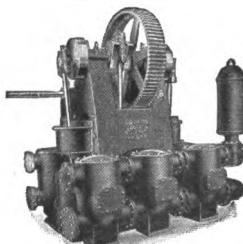


Figure 1590

- Boiler Feeding
- Elevator Service
- Circulating
- Semi Fluid
- Drainage
- Irrigation
- Air Pressure
- Fire Service
- Chemicals
- General Water Supply
- Mines
- Pulp Grinders
- Railway Water Stations
- Tank Pumping
- Bleacheries
- Dye Houses
- Tanneries
- Refineries
- Oil Pipe Lines
- Hydraulic Presses
- Condenser Service
- Sprinkler Systems
- Filter Presses
- Cyanide Pumping
- Soap, Tar, Sewage

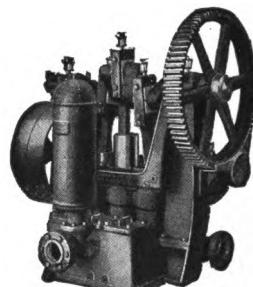


Figure 924

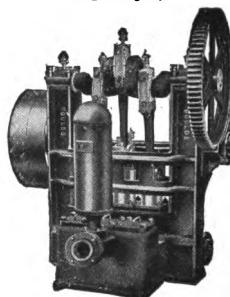


Figure 1009

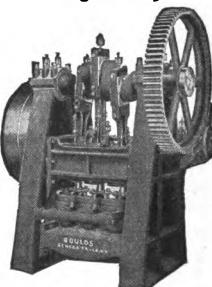


Figure 997—4½ x 8, No. D

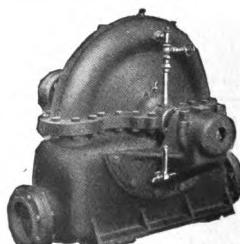


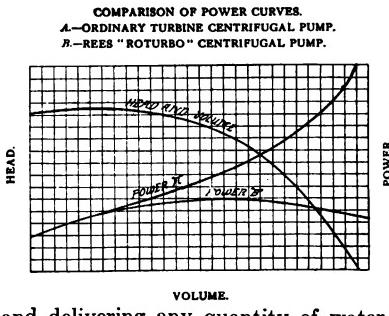
Figure 3001, No. 6

Ask for  
Bulletins on Power or  
Hand Pumps for any  
service in which you  
are interested

# MANISTEE IRON WORKS CO.

MANISTEE, MICH.

Sole manufacturers and licensees for the United States and Canada for the  
**REES ROTURBO PATENT PRESSURE CHAMBER PUMP, ROTARY JET  
 CONDENSER, AND AIR PUMP.**

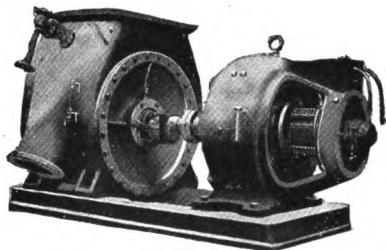
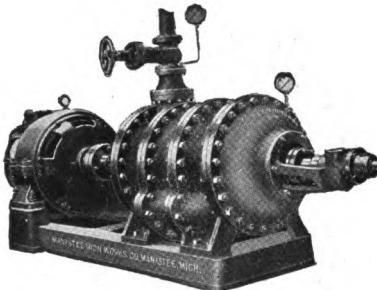


and delivering any quantity of water that may be required.

The distinctive features of these pumps are shown by the curves given. The H.P. taken by the Rees Roturbo Pump is considerably less than that taken by the ordinary turbine Centrifugal pump. This is shown clearly by the difference between the curves "A" and "B." The result of this is that the efficiency curve of the Rees Roturbo is sustained at a high figure over a wider range.

We are building these pumps for any service and type, either belt-driven, steam engine, electric motor or turbine; also for pumping to any height

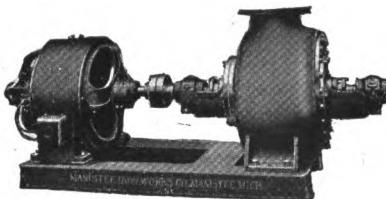
The illustration at the side is of a Rees Roturbo High Lift Colliery Pump delivering 60,000 gallons per hour. 570 ft. 1140 r.p.m. 79% efficiency.



The illustration here shows a Rees Roturbo Low Lift Pump delivering 30,000 gallons per hour. 28 ft. head, 900 r.p.m. 78% efficiency.

The figure here shows a Rees Roturbo Rotary Jet Condenser. These can be driven by either Electrical Motors, Steam Engines or Steam Turbine.

The vacuum attained is within a fraction of an inch of the theoretical possible. The condenser is extremely simple, having one Rotating Shaft and impeller only. There are no other moving parts whatever. The Rees Roturbo Rotary Air Pump is on the same principle. Full details and quotations on application.

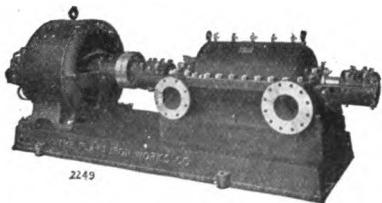


## THE PLATT IRON WORKS CO.

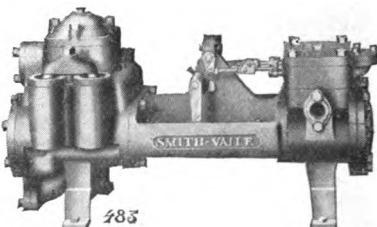
GENERAL OFFICES: DAYTON, OHIO.

Branch Offices in all Principal Cities.

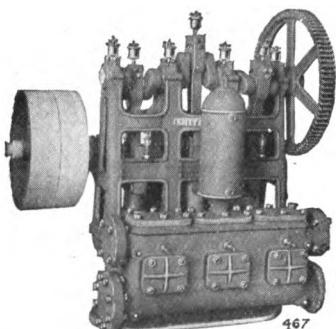
CENTRIFUGAL AND TURBINE PUMPS, STEAM AND POWER PUMPING MACHINERY, WATER WHEELS, FEED WATER HEATERS, AIR COMPRESSORS, OIL MILL EQUIPMENT, CONDENSING APPARATUS.



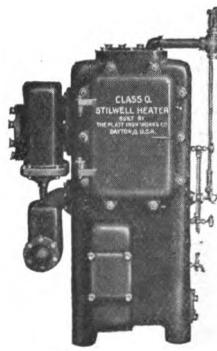
"Platt" Centrifugal Pumps—Single and Multi Stage, of all sizes—for all classes of service.



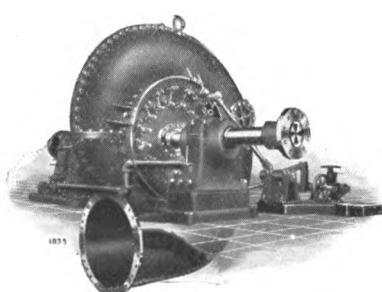
"Smith-Vaile" Steam Pumps in all sizes and types, from Boiler Feed to Corliss Pumping Engines.



"Smith-Vaile" Power Pumps—Duplex and Triplex, Horizontal and Vertical.



"Stilwell" Feed Water Heaters—Open, Closed and Multi Current types. Hot Water Service Heaters.



Victor-Francis Turbine Water Wheels. Standard wheels for all Heads and Powers. Special wheels for special developments.

We maintain a corps of specialists in every department, thus assuring our customers the best possible service.

Catalogues and bulletins sent on request.

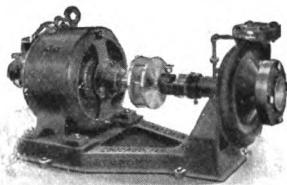
## THOMAS & SMITH, INC.

116 N. CARPENTER STREET, CHICAGO, ILL.

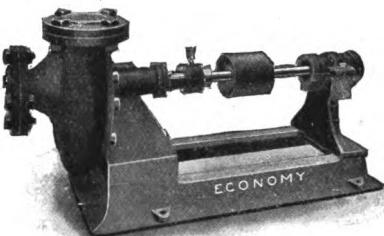
Agencies in all Larger Cities

Manufacturers of

### "ECONOMY" PUMPING EQUIPMENT

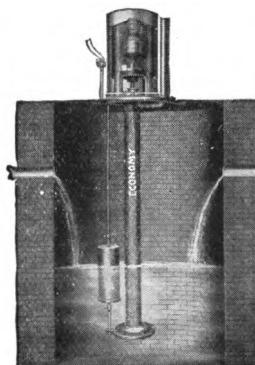


Motor Driven Centrifugal Pump



Belt Driven Centrifugal Pump

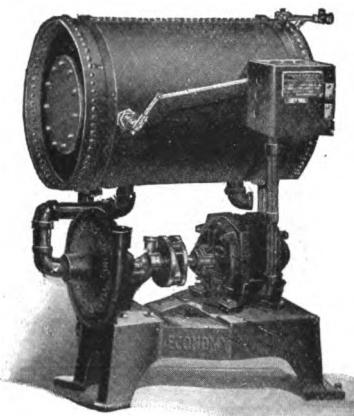
"Economy" Centrifugals are made in single and multi stage for any capacity at any head, both belted and direct connected to motor or engine. They are of the highest grade, having machined parts and castings, and are being used efficiently for pumping liquids containing large percentages of solids.



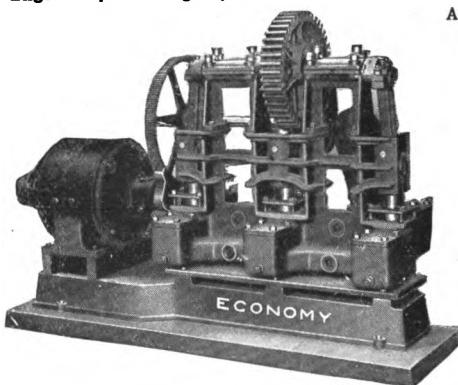
Bilge Pump or Sewage Ejector

The "Economy" Automatic Bilge Pump or Sewage Ejector is made for any capacity at any Head. Either single or duplex arrangement for the Submersible or Dry Basin Type.

They are also used for other purposes such as pumping various liquids from retorts, cisterns and tanks.



Automatic Condensation Pump and Receiver



"Economy" Triplex Pump

Note the compact, yet sturdy design. Built for heavy duty.

The "Economy" Automatic Condensation Pump and Receiver is connected with the return line, near or at any distance from the boiler and is especially essential where there are low places in the pipe lines or low radiators that collect the condensation.

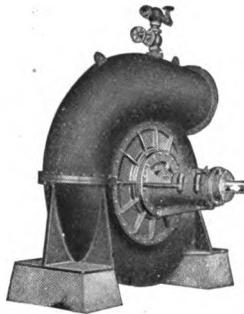
There is an "Economy" Pump to meet every demand. Forty-three different designs.

Write for complete catalog and a set of specifications covering each type.

# MORRIS MACHINE WORKS

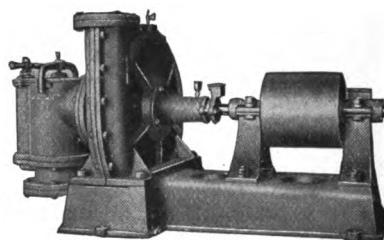
BALDWINSVILLE, N. Y.

CENTRIFUGAL PUMPING MACHINERY, STATIONARY AND MARINE ENGINES AND HYDRAULIC DREDGES.



Morris Centrifugal Pumps are simple in construction: they have only rotary parts, perfectly balanced, no reciprocating parts or valves; require small space and foundation; have high efficiency; are equally suitable for small up to very large capacities, and can handle sand or solids with the water without injury. These pumps direct connected to reciprocating engines are suitable for moderate heads, or direct connected to electric motor or steam turbine (or belt driven) for high heads. For heads above about 100 feet, pumps are built in stages.

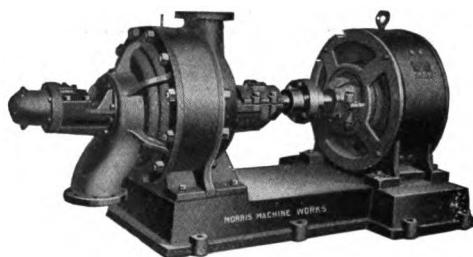
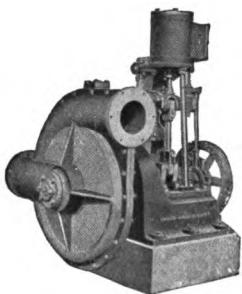
When making inquiries for pumps, full information should be given—that is, quantity desired, head, including friction (or give actual elevation and length of suction and discharge piping), type of pump desired, how driven—whether belt, steam engine, electric motor (give electric current characteristics), arrangement of suction and discharge openings desired, whether right hand or left hand, etc.



## MORRIS IMPROVED STANDARD IRON HORIZONTAL PUMP.

No. Pump (Diam- eter Dis- charge Open- ing)	Size Pipe Flange on Suction, Inches	Eco- nomical Capacity, for each Gallons per Minute	Horse- Power Required Pulley. Foot Head	Diameter and Face of pulley in Inches	Floor Space Required in Inches. Without Primer	Shipping Weight Without Primer. Lbs.	Shipping Weight With Primer. Lbs.	N. Pump
1 $\frac{1}{2}$	2	70	.058	6 x 6	17 x 31	175	220	1 $\frac{1}{2}$
1 $\frac{3}{4}$	2	90	.075	7 x 8	21 x 32	260	305	1 $\frac{3}{4}$
2	3	120	.10	8 x 8	23 x 37	350	415	2
2 $\frac{1}{2}$	3	180	.15	8 x 8	24 x 38	380	430	2 $\frac{1}{2}$
3	4	260	.22	8 x 8	25 x 39	415	495	3
4	5	470	.30	10 x 10	29 x 41	615	720	4
5	6	735	.45	12 x 12	34 x 54	940	1075	5
6	8	1050	.59	15 x 12	37 x 55	1180	1345	6
8	10	2000	1.00	20 x 12	45 x 64	2065	2430	8
10	12	3000	1.52	24 x 12	51 x 69	2610	2940	10
12	15	4200	2.00	30 x 14	63 x 71	3615	....	12
15	18	7900	3.50	40 x 15	77 x 80	7100	....	15
15	18	7900	3.50	30 x 15	60 x 68	3150	....	15
18	20	10000	4.50	40 x 16	93 x 103	9000	....	18
18	20	10000	4.50	30 x 16	66 x 72	4835	....	18
20	22	12000	5.40	36 x 20	73 x 83	6800	....	20
22	24	13000	5.50	48 x 20	126 x 130	....	....	22
24	24	15000	6.50	43 x 36	94 x 137	....	....	24

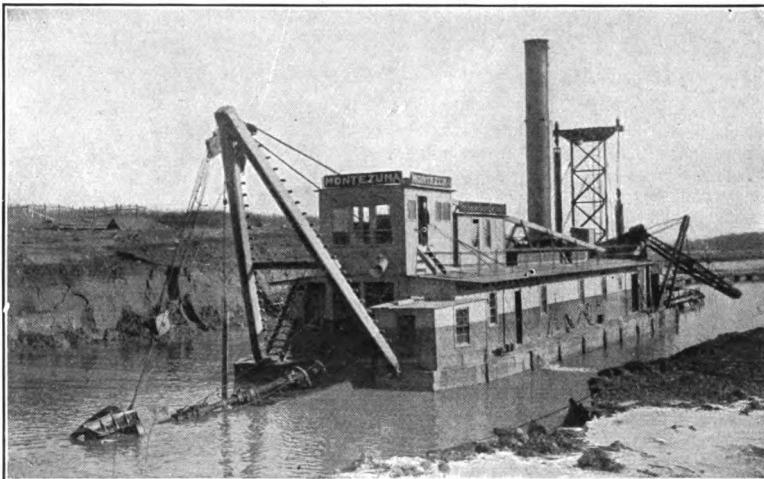
## MORRIS MACHINE WORKS



We build CENTRIFUGAL PUMPS for almost any service and of all types, including side suction and double suction, vertical or horizontal shaft. STAGE PUMPS for high heads. TWIN PUMPS for large capacities and high speeds. Or will design SPECIAL PUMPS to suit special conditions. We also build a very complete line of STATIONARY AND MARINE ENGINES, in single cylinder, compound and triple expansion types.

### DREDGING PUMPS.

MORRIS Dredging Pumps are made in sizes from 2" discharge and upward, both lined and unlined. They are belt driven or direct connected to steam engines. We can furnish pumps only or the complete dredge including all machinery.



20" HYDRAULIC DREDGE with 750 H.P. MORRIS Triple Expansion Engine, Water Tube Boilers, Cutter Machinery. This Size Dredge Has an Average Capacity of 250,000 Cubic Yards of Material per Month.

## R. D. WOOD & COMPANY

PHILADELPHIA, PA.

ENGINEER, IRON FOUNDERS AND MACHINISTS; PUMPING ENGINES CENTRIFUGAL PUMPS, HYDRAULIC MACHINERY, GAS HOLDERS AND APPLIANCES, GENERAL MACHINERY, CAST IRON PIPE, HYDRANTS AND VALVES, GAS PRODUCERS, GAS WASHERS

### PUMPING ENGINES

Vertical Triple Expansion, and Direct Acting for Water Works, Sewage, Irrigation and for high pressures. High duty pumping engines of both the crank and fly wheel and direct-acting types. Designed to combine highest economic duty and efficiency with greatest reliability and utmost simplicity.

Estimates and drawings (either exact or preliminary) furnished upon application, with statement of requirements to be fulfilled.

### CENTRIFUGAL PUMPS

Of most modern design and highest efficiency, for Water Works, High Pressure Systems, Irrigation and general service.

Following is the classification of our Standard Pumps:

### SERVICE

- Class C. Compound Multi-stage Pumps for High Heads.
- Class H. High Lift Pumps, Single Stage, 40 feet and upwards.
- Class M. Medium Lift Pumps, Single Stage, 20 to 40 ft.
- Class L. Low Lift Pumps, Single Stage, 0 to 20 feet.
- Class D. Dredging Pumps, Single Stage, 0 to 60 feet.
- Class T. Pulp Pumps, Single Stage, 0 to 40 feet.
- Class Q. Special Pumps, Single Stage, in connection with above.

### CAST IRON PIPE

Bell and Spigot Pipe from 1 inch to 84 inches in diameter, Flange Special deep bell, High Pressure, Flexible joint for submarine work, and every form of pipe and special casting, as well as heavy Loam Castings.



### HYDRAULIC MACHINERY

Hydraulic Presses of every description for the heaviest work, Punches, Shears, Riveters, Intensifiers, Hoists, Pressure Pumps, Cranes, Valves, etc. etc. For the majority of operations to which hydraulic power can be applied, and especially those requiring very great force exerted through a comparatively short stroke, as in riveting, punching, shearing, lifting, forging and flanging, there is no other system at all comparable with it for efficiency, uniformity, simplicity or economy. This is true for several reasons; primarily in that there is absolutely no motion or power consumed except in the act and at the moment of performing the desired operation.

## R. D. WOOD & COMPANY

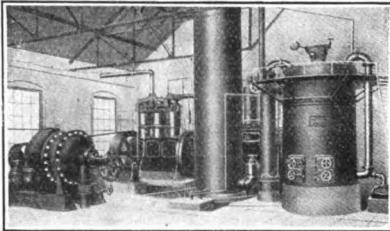
### HYDRANTS AND VALVES

Fire Hydrants, Mathews patents for standard and high pressure. Gate, Check, Foot and Air Valves, Valve Boxes, Indicator Posts, Foot Valve and Intake screens, Hook Racks, etc.

### PRODUCER GAS PLANTS

We have had years of experience in the building of producers for all kinds of fuel purposes as well as for power, and our customers may be certain of securing apparatus suitable to their requirements both from an economic and operating standpoint.

Our engineering department is at your service, and we would be pleased to have our representative visit your plant and give full details.



### GAS HOLDERS AND APPLIANCES

Gas holders of largest dimensions and all machinery and appliances relating to gas works.

### SINGLE OR MULTIPLE LIFT GAS HOLDERS

With or without steel tanks.

### MITCHELL SCRUBBER

Matton & Mitchell Self-Sealing Mouthpieces, Purifiers, Condensers, Scrubbers, Bench Work, Center Seals, Gas Valves, Lamp Posts, etc.

### GAS WASHERS

We control for the United States the Theisen Gas Washing Process, which we build for producer and blast furnace gas. This Process was adopted by the United States Steel Company at Gary, and is being put in with all their new construction. It delivers the gas to an engine cleaner than the air in the mixture.

### GENERAL MACHINERY

Our shops are well equipped for building large machinery of every description, such as sugar, chemical and similar work.

### INQUIRIES

For Pipe should state size, kind, approximate quantity and weight or pressure under which they will be used; and if possible the intended service, also delivery desired.

## Pumping Machinery

# WILSON-SNYDER MFG. CO.

General Office and Works

PITTSBURGH, PA.

### STEAM PUMPS

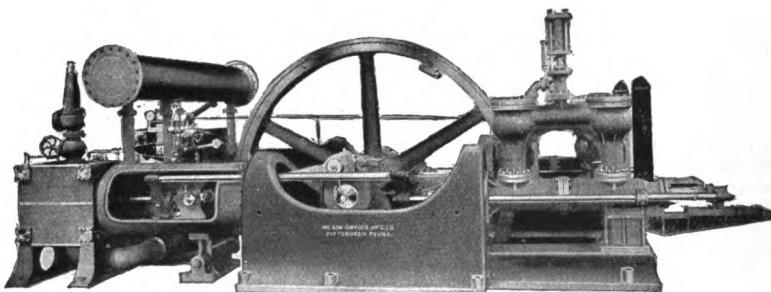
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### CENTRIFUGAL PUMPS

Readily Accessible

### ELECTRIC PUMPS

Accurate Workmanship



PUMPING ENGINE FOR PIPE LINE SERVICE

Normal capacity 20,000 barrels per day against 1000 lb. pressure.

Our standards are based on long stroke as the cardinal principle. So far as possible the interchangeable system of construction has been adopted. Bronze bushings and burrs, for example, are all interchangeable. We need hardly dwell on the immense advantage which this system offers. Instead of waiting, perhaps, weeks for the making of a trivial repair part, you have merely to telegraph or write to us for a new piece.

### PARTIAL LIST OF WILSON-SNYDER PRODUCTS

Accumulators	Independent Air Pumps and Jet Condensers
Air Compressors	Direct Acting, Single
Direct Acting, High Pressure	Jet Condensers
Air Pumps	Mine Pumps
Direct Acting, Independent with Jet Condenser	Direct Acting, Duplex, Centrifugal
Automatic Steam Regulating Valve	Piston Pumps
Automatic Water Regulating Valve, for Pump Pit	Direct Acting, Duplex
Boiler Feed Pumps, all types	Plunger Pumps
Centrifugal Pumps	Compound and Duplex, Triple, Direct Acting
Large volumes, low heads	Power Pumps
Medium volumes, high heads.	Duplex, Triplex, Vertical and Horizontal
Compound Duplex Pumps	Regulating Balanced Valve for Accumulators
Piston, Plunger, Condensing, Non-Condensing, Hydraulic, Vertical and Horizontal	Regulating Valve for High Pressure Pumps
Direct Acting Pumps	Steam Separators
Air, Boiler Feed, Mine, Piston, Plunger, Tank or Light Service	Steam Valves for Direct Acting Pumps
Duplex Power Pumps, all services	Tank or Light Service Pumps
Duplex Pumps, for all services	Direct Acting, Duplex
High Duty Pumping Engines	Tar Pumps
Horizontal Cross Compound	Triple Expansion Pumps
Vertical Cross Compound	Triplex Power Pumps for Hydraulic Service
Vertical Triple Expansion	Vacuum Pumps
Hydraulic Compound Duplex Pumps	Vertical Compound Duplex Pumps
Hydraulic Crank and Flywheel Pumps	Vertical Cross Compound Pumps
	Vertical Triple Expansion Pumps

# THE HILL PUMP VALVE CO.

CHICAGO, ILL.

HILL PUMP VALVES FOR BOILER FEED, VACUUM, ELEVATOR AND  
MINE PUMPS, PUMPING ENGINES, TAR, OIL AND BRINE PUMPS

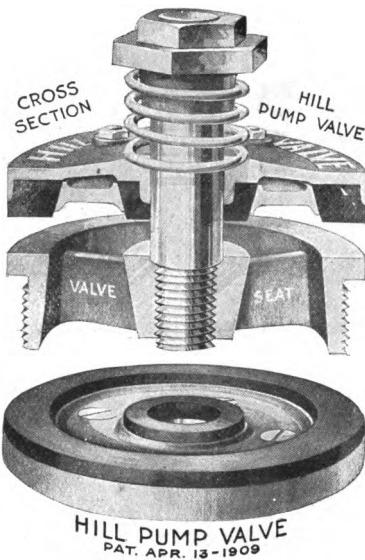
The only valve that *stays* efficient.

Hill Valves always seal tight, wear evenly and cannot ride on the bridges.

Pumps equipped with this type of valve give highest possible efficiency and capacity and continue to do so.

Installation of Hill Valves increases a pump's efficiency from 10 to 50%.

Made in all sizes 2" to 8" diameter.



## CONSTRUCTION

The construction of this valve is shown in the cut. The valve consists of a bronze body carrying two composition seal rings, the seal rings being retained in place by the outer and inner lips of the body and by a concentric wedge ring. The body has a central sleeve bearing which fits loosely on the stem. The inner ring does not come in contact with the stem. The binder ring is bronze and is held to the valve body by brass screws and lock nuts. All similar parts of valves of the same size and type are interchangeable.

The valve seat has three ribs except in the larger sizes. The ribs of the seat are not required to support the valve and thus the lesser number increase the area of the waterway, and greatly decrease the friction. The bridges are machined below the seating surface so that the water stands above them even when the valve is on its seat.

The valve stems are Tobin bronze. The upper end is threaded for the spring cap and lock nut. The spring cap is grooved to center the spring.

The spring is made of a superior grade of phosphor bronze wire of suitable tension to seat the valve properly.

The lift of the valve is such as to give a free waterway area equal to or slightly in excess of the free waterway area of the seat.

Many pumps have seats which conform sufficiently to the Hill Valve to obviate the necessity of changing seats.

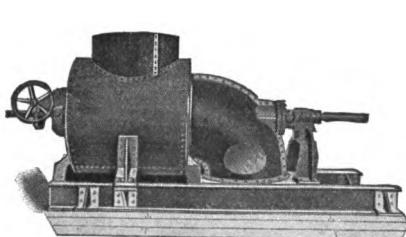
For further information address the Hill Pump Valve Co., Chicago.

# HOLYOKE MACHINE COMPANY

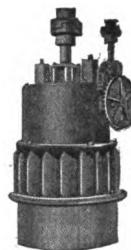
HOLYOKE, MASS.

## WATER WHEELS AND GEARING

SHAFTING AND MILL WORK, PUMPS, HYDRAULIC PRESSES, PAPER AND WOOD  
PULP MACHINERY, ETC.



Horizontal Turbine



Vertical Turbine

## WATER POWER DEVELOPMENTS

The Holyoke Machine Co. has complete engineering and manufacturing facilities for the development of water power plants of all kinds. We are prepared to furnish designs and machinery of standard or special pattern, and are always glad to bid for work in our line. The services of our engineering staff are always at the service of prospective purchasers.

We manufacture Boyden and Hercules Turbine Wheels, both vertical and horizontal, with flumes and all connections. Water Wheel Governors and Head Gates to suit all conditions and all necessary gears, shafts, pulleys, and Mill Work.

## BEVEL, MITER AND SPUR GEARS

Our gears are made of Charcoal Iron of such mixture as insures maximum strength and durability, making them far superior to Gears made from ordinary Anthracite Iron. Our collection of gear patterns is one of the largest in the country, and all patterns are kept in first-class condition. We have pattern-makers constantly employed in making new gear patterns, and can usually furnish gears from special patterns to order in a short time.

*PLANED GEARS.* For many years we have made a specialty of Planed Gears, and with large facilities for such manufacture, we are prepared to furnish both Bevel and Spur, Angle and Mortise Gears, finished with exactness and promptness. Catalog on request.

## OTHER PRODUCTS

Other manufactures of the Holyoke Machine Company include: Improved Paper Machinery and Machinery for Wood Pulp Mills, Cotton, Paper, and Husk Rolls. Chilled Iron Rolls, Machinery for Bleacheries and Dye Works, Rotary Fire Pumps, and Friction Drives, Power Pumps, Hydraulic Presses and Pump.

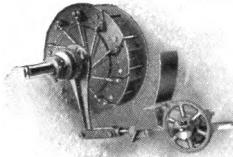
Special Machinery and Iron Castings of every description made to order.

# RODNEY HUNT MACHINE COMPANY

ORANGE, MASS., U. S. A.

TURBINE WATER WHEELS, FLUMES, PENSTOCKS, CANAL AND RESERVOIR  
GATE APPARATUS, ROTARY, TURBINE AND CENTRIFUGAL PUMPS,  
HEAVY POWER TRANSMISSION EQUIPMENTS, TEXTILE  
WET FINISHING MACHINERY

## HUNT IMPROVED DRAW BAR GATE APPARATUS



a pin clutch on the side. The main gate shaft, extending over the clutch spur gear, operates same with small pinion spur gear so that engaging or disengaging operation of the gearing when running is readily and quickly effected by use of a pin clutch.

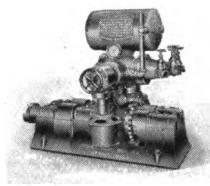
## HOISTING AND HEAD GATE APPARATUS



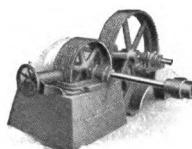
Having one of the largest assortments of both Hoisting Apparatus and Head Gate Apparatus, we are able to offer designs meeting practically every requirement both for Gates and Hoisting Mechanisms. Also Wood Bulk Head Gates, etc. See Catalog 29, Section H-G.

## ROTARY FIRE PUMPS

(National Standard Type A and B)



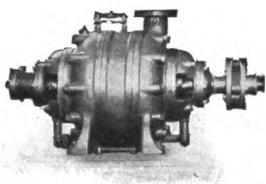
The water passages are made larger than in pumps hitherto built. In order that it may start instantly at all times, the working cams and water casings are made of solid brass. The shafts are very heavy, with liberal bearings. Fittings include a pressure valve, a relief gauge and cone, a priming pipe and valve, a starting valve, two to six hose valves, and a capacity plate.



## POWER TRANSMISSION FRICTION GEARS

Our heavy duty Grooved Friction Gears are of substantial design throughout. The spring yoke press frames with angular split bearings ensure even distribution of pressure over the full face of both gears. Also angle of grooves gives high efficiency results. Approved and accepted by the Underwriters for fire pump service.

## TURBINE AND CENTRIFUGAL PUMPS



Our Turbine Pumps are especially adapted for operating by electric motors. Proper provision for every requirement for such pumps is made in our design. Absence from vibration readily tested by balancing a coin on casing when in operation.

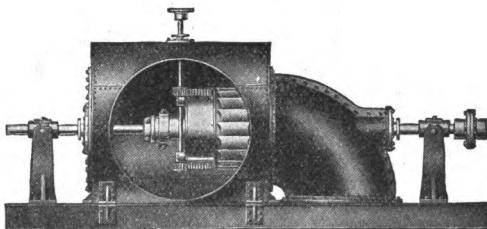
Our Centrifugal Pumps are constructed with special reference to durability and long service, and are adapted for practically every requirement.

## *Hydraulic Turbines*

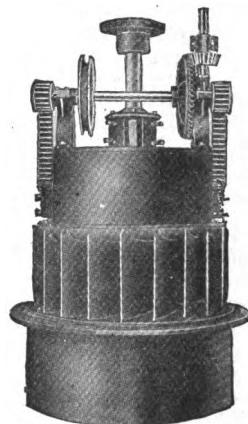
J. & W. JOLLY

HOLYOKE, MASS., U. S. A.

HORIZONTAL AND VERTICAL TURBINES



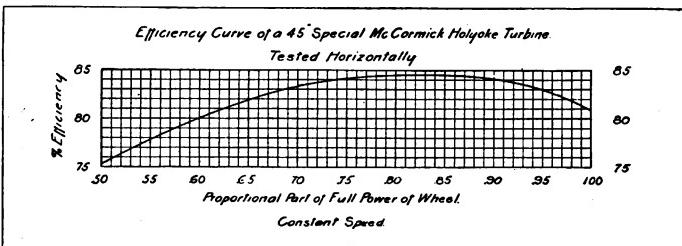
McCormick Cylinder Gate Turbines, Horizontal Type,  
in Steel Flume



McCormick Vertical  
Turbines

We build turbines in all sizes and styles, both cylinder and swing gates, to meet ordinary conditions, and design new wheels to meet special conditions of power and speed. We guarantee results in all cases. We would call particular attention to the efficiency curve shown below, which was plotted from results shown by the official test sheet. This wheel, when tested in the flume of the Holyoke Water Power Co., was mounted on a horizontal shaft, and discharged through a quarter-turn elbow and draft tube, thus giving results under actual working conditions.

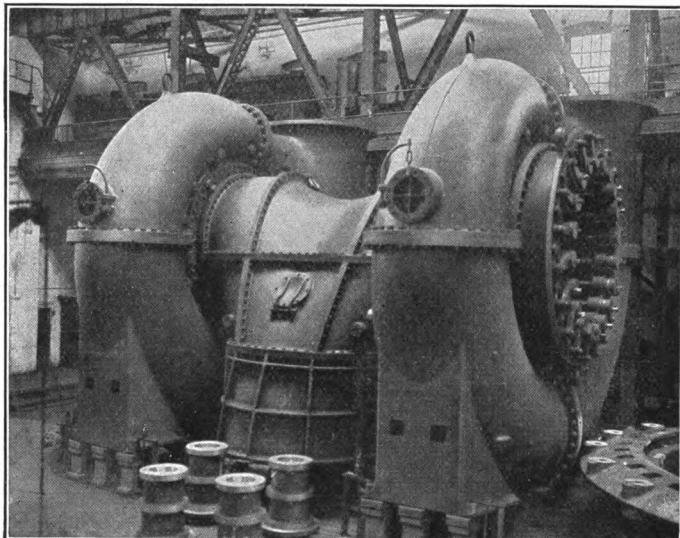
Note that constant speed is maintained at all stages of power.



We also build Headgates complete with operating mechanisms of various designs for gates opening either vertically or horizontally.

I. P. MORRIS COMPANY  
HYDRAULIC DEPARTMENT  
PHILADELPHIA, PA.

SPECIALISTS IN THE DESIGN AND CONSTRUCTION OF HIGH CLASS, HIGH POWER AND HIGH EFFICIENCY HYDRAULIC TURBINES



22,500 H. P. TURBINE

Two units furnished. Head, 168 ft. Speed 200 R. P. M.  
Most Powerful Water Turbines in existence

The I. P. Morris Company in 1851 built its first hydraulic turbines, which were used continuously by the Water Works Department of Philadelphia until superseded by the present filtration system, in 1908.

Since these first turbines were built, the art of turbine design has reached the perfection shown by the accompanying extract from the Report of the Holyoke Water Power Company, on an experimental runner tested in April, 1912. This runner holds the record for efficiency at the Holyoke testing flume.

Gate	Head	R.P.M.	Horse-power	Efficiency
4	17.52	232	102.53	79.41
3.5	17.58	230.75	101.54	81.43
3.0	17.41	232	94.1	88.01
2.65	17.44	233.75	90.57	90.62
2.5	17.48	225.25	84.51	89.61
2.00	17.75	233.33	64.27	81.98
1.25	18.32	227.75	34.47	73.05

Since the I. P. Morris Company began active construction of hydraulic turbines, it has designed and built turbines aggregating 1,148,725 horse-power, of which 273,725 horse-power has been contracted for within the past eleven months.

Inquiries for turbines requiring special design will be given every attention.

## *Crushers*

# PENNSYLVANIA CRUSHER CO.

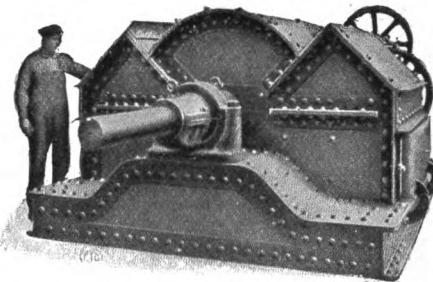
STEPHEN GIRARD BLD'G.

New York, 50 Church St. PHILADELPHIA, PA. Pittsburgh, Macheaney Bld'g.  
COAL CRUSHING & CLEANING MACHINERY FOR BY-PRODUCT COKE PLANTS, SWING-HAMMER CRUSHERS, BRADFORD COAL CLEANERS, ROTARY & JAW CRUSHERS, SINGLE ROLL CRUSHERS, GRINDING PANS, DELAMATER "SINK & FLOAT" TESTERS.

### "PENNSYLVANIA" SWING-HAMMER CRUSHERS

Extensively used for pulverizing Bituminous Coals in By-Product and Bee-Hive Coking Plants; also for crushing Cement Rocks and Limestones in Cement Mills; also Lime, Shales, Bone and a multitude of other materials.

Main frame of fabricated Steel practically immune from breakage. Removable Steel Wear Liners, Ball and Socket Bearings, 6 and 8 rows of Hammers, large diameter Steel Discs, quick adjustable Grinding Cage. By weight the "Pennsylvania" is more than 90% Steel.



Hammer Crushers

### "PENNSYLVANIA" BRADFORD COAL CLEANERS

For Power Houses and By-Product Coke Plants

One of the important uses of this machine is to automatically remove impurities such as slate, bone, sulphur balls or binder from bituminous steam or coking coals, thereby reducing the ash and sulphur contents.

It is used extensively in preparing R.O.M. coals in By-Product Coking Plants and Bee-Hive Ovens.

In connection with its crushing and cleaning functions for R.O.M. coal for large Power Houses, the "Pennsylvania" Bradfords are most efficient in removing stray iron, coupling pins, mine props and all sorts of impedimenta that damage Conveyors, Stokers and other Power House machinery.

For Stoker feed it Crushes R.O.M. with less fines than Rolls, or any other type.

Absolutely automatic in operation, easy on horse power, runs 12 to 15 R.P.M., requires no labor to operate, other than occasional oiling. Is practically "fool-proof."

Several of these "Pennsylvania" Bradfords are successfully operating in connection with Coal Washers.

### "PENNSYLVANIA" SINGLE ROLL CRUSHERS

Will take large pieces of Coal, Coke, Iron Ore, Limestone, Phosphate, Gypsum, Flint Clay and reduce to one inch and finer in one operation. A good machine for crushing coal for Stokers.

A single roll revolving close to a quickly adjustable breaker plate, in place of two rolls commonly used.

Roll is heavily back geared and rigidly held in its bearings to prevent spreading when feeding large lumps. This design is smoother running than the double Roll.

Bed frame in one piece and very rigid. Cut shows rear panel removed, exposing roll. Different designs of roll teeth are made. Moderate H. P., slow speed.

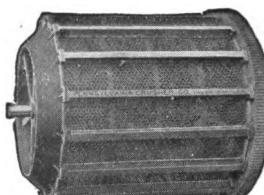
### "PENNSYLVANIA" ROCK CRUSHERS

Powerfully built for brutal service, free from hot boxes, broken shafts and other common troubles.

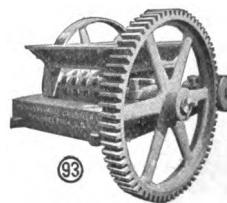
Simple in design, of few parts, and require no expert for repairs. Thoroughly reliable under trying conditions.

Main frame is Open-Hearth Steel, shafts are high grade Steel forgings.

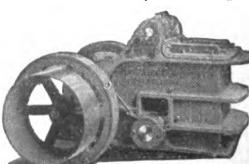
Bearing made to template, are kept in stock by operator and easily replaceable.



Bradford Coal Cleaner



Roll Crusher



Rock Crusher

## STURTEVANT MILL CO.

BOSTON, MASS.

NEW YORK      PITTSBURGH      CLEVELAND      CHICAGO      ATLANTA      LONDON

**CRUSHERS, CRUSHING ROLLS, GRINDING MILLS, LABORATORY MACHINERY,  
SCREENS, MIXERS, SACKING AND WEIGHING MACHINES**

**CRUSHERS**—Coarse Crushers: for Breaking large Rocks and Ores to from 4 in. to 2 in. in size and finer.

Intermediate Crushers: for reducing to from 1 in. to 2 in. and finer.

Fine Crushers: for 1 in. to  $\frac{1}{2}$  in. crushing.

Rotar Fine Crushers: "Open Door" type for crushing soft and moderately hard rock.

Laboratory Crushers: for Sampling.

**CRUSHING ROLLS**—Balanced Rolls: Highest Grade, for Roughing and Finishing. Special Car-Box Bearings. Shocks only one quarter that of other Rolls. Springs back of each bearing.

Plain Balanced Rolls: One half the weight and approximately one half the price of Balanced Rolls.

Laboratory Rolls: for Sampling.

**GRINDING MILLS**—Ring-Roll Mills: for pulverizing dry materials such as Quartz, Cement Clinker, Coal, Limestone, Granite, Trap, Phosphate Rock, etc. Large outputs, small power and upkeep. Built in large and small sizes. Emery Mills: for pulverizing soft and moderately hard materials, such as Lime, Gypsum, Talc, Clay, etc., etc. Horizontal and Vertical types—many sizes.

Sample Grinders: for Laboratory use.

Various other grinding devices for special purposes.

**LABORATORY MACHINERY**—Crushers: "Open Door" accessible type. Hand-Wheel adjustment—easily cleaned.

Rolls: for granulation and pulverization. "Open Door" type; automatic adjustments.

Grinders: for fine grinding—"Open Door," Hand-Wheel adjustment.

Screens: for accuracy, "Open Door."

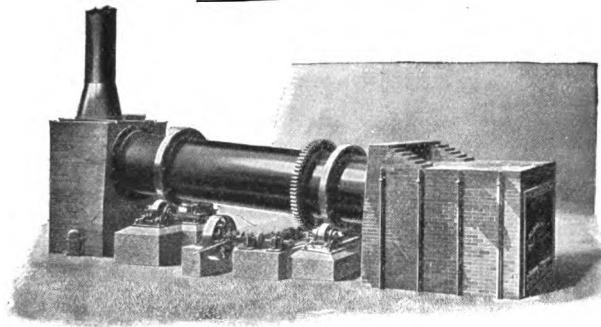
**SCREENS**—Newaygo Separators; for screening everything screenable from 4 to 180 mesh. "Open Door" Inclined Vibrating type. Screen cloth automatically stretched and kept taut and vibrated by hundreds of little hammer blows upon its reenforced surface. Coarse Wire used for fine and accurate output. Large capacity.

**MIXERS**—Hunso Automatic Mixers for Fertilizer.

**SACKING AND WEIGHING MACHINES**—Sawyer-Fulford Revolving Sacking and Weighing Machines. Accurate to an ounce. Sacks and weighs most anything that will go in a bag.

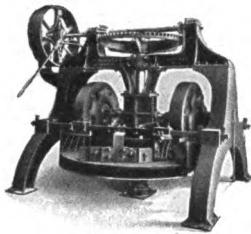
**AMERICAN CLAY MACHINERY CO.**  
BUCYRUS, OHIO

**ROTARY DRYERS, WET AND DRY GRINDING MILLS,  
ROLLER CRUSHERS, EXHAUST FANS AND DISC FANS**

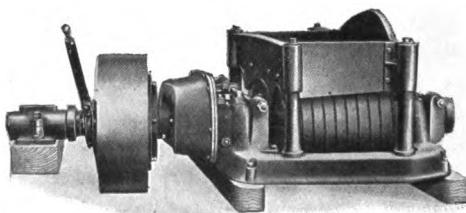


**Rotary Dryer**

**ROTARY DRYERS.** We manufacture a line of Rotary Dryers covering a large range of sizes and capacities and adapted to drying clays, shales, sands, marls, slurries, fertilizers, crushed limestone, and for calcining fire clays, roasting ores, and handling a great variety of other materials from which moisture must be removed at low cost, or in which special heat treatment is required.



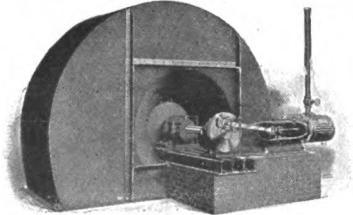
**Grinding Mill**



**Roller Crusher**

**WET AND DRY GRINDING MILLS.** We manufacture a line of wet and dry grinding machines, as shown in illustration. They are largely used by steel foundries in mixing and grinding silica sand and similar materials. They are made in a full range of sizes from 5 feet to 9 feet and for either motor or belt drive.

**ROLLER CRUSHERS.** We build a complete line of Roller Crushers for crushing and grinding clay, gravel, etc. They are extensively used for stone extracting where the material to be crushed contains stones.



**Exhaust Fan**



**Disc Fan**

**EXHAUST FANS AND DISC FANS.** We manufacture a complete line of Exhaust Fans including all sizes up to No. 360. These fans are made either three-quarter-housed or full-housed, and are extensively used for ventilation and dryer work. For full details see our No. 90 catalog.

## J. P. DEVINE COMPANY

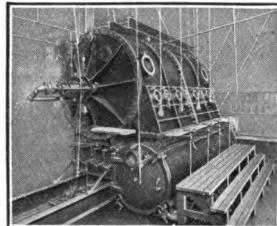
BUFFALO, N. Y.

### MANUFACTURERS OF VACUUM DRYING AND EVAPORATING APPARATUS

**VACUUM DRUM DRYERS** for Dyewood and Tanning Extracts, Milk and Food Products, Pastes, etc.

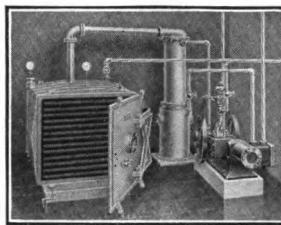
A rapid and uniform drying is effected because the drum dips into the solution and takes up a thin film of the wet material of 1-125 of an inch and less. The water is evaporated from the material at a temperature of from 117° F. to 96° F. according to the Vacuum in the apparatus of 26 $\frac{3}{4}$ " to 28 $\frac{1}{4}$ ".

The drying process is continuous and independent of climatic conditions; free from dust and consequent elimination of danger to health of employees and destruction of property; and at a minimum cost of operation, including labor.



**VACUUM CHAMBER DRYERS** for Colors, Dyes, Extracts, Salts, Rubber, Smokeless Powder and High Explosives, and other Chemical and Food Products.

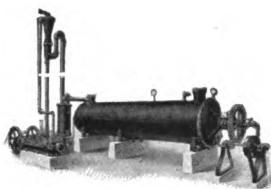
The Vacuum Drying Chamber is designed to remove the water rapidly and at a low temperature from materials which cannot be dried by methods used heretofore without altering their chemical composition on account of their sensitiveness to heat. It may also be used with great saving in time, fuel, cost of plant, and working expenses for other substances where a low temperature is not an absolute necessity.



Materials which are difficult to dry in the atmosphere or which cannot be dried at all in the atmosphere without decomposition have all moisture removed from them in a very short time in the vacuum chamber without danger of impairing their qualities by overheating.

**VACUUM ROTARY DRYERS**, for Starch, Granular Substances, and Chemical By-Products.

The moist material is conveyed by an elevator into a hopper high above the manhole to facilitate the charging of the apparatus. After charging, the manhole is closed and a high vacuum produced by means of an air pump, the vapors passing into the condenser.



Concentric with the steam jacketed outside cylinder is a revolving inside drum, heated by live or exhaust steam, to which stirring blades are attached. The material to be dried is between the inside drum and the outside cylinder and is kept in constant motion by the stirring blades. Thus every particle comes into close contact periodically with the heating surfaces, and a very thorough and even drying process results.

**VACUUM PUMPS** of highest efficiency and of non-corrosive metals.

**VACUUM PANS** for any requirement and capacity in single or multiple effect.

**CONDENSERS, ETC.**

**OVER 3,000 INSTALLATIONS IN DAILY OPERATION.**

## Dryers

# RUGGLES-COLES ENGINEERING CO.

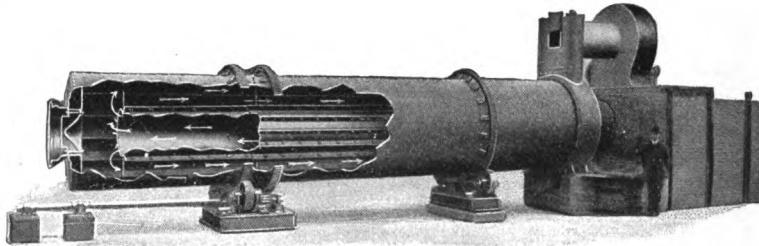
McCORMICK BLDG.  
CHICAGO

50 CHURCH STREET  
NEW YORK CITY

## RUGGLES-COLES "Double Shell" DRYERS

Consulting and Contracting  
Engineers

Designers and Builders of  
Special Machinery



Section of Ruggles-Coles Dryer Showing Direction of Cases

## RUGGLES-COLES "Double Shell" DRYERS

We build Ruggles-Coles "Double-Shell" Dryers for drying a large variety of inorganic and organic materials. For this work we have perfected six regular types of dryers, but for certain substances we build special dryers to order. After fourteen years' successful experience we know that the Ruggles-Coles Dryer is designed on the correct principle and point to more than 300 satisfactory installations in all parts of the world as evidence of its superiority.

**Class "A" Dryer.**—The principle of the Ruggles-Coles "Double-Shell" Dryer is that the material being dried passes the hot gases in the opposite direction to their travel. The Class "A" dryer consists of two concentric shells rigidly connected at the center. Between this point and each end are two sets of swinging arms allowing for unavoidable expansions and contractions. The inner cylinder at the head of feed end is connected with the furnace by a hot air flue lined with fire brick. At the discharge end is a revolving head on the inside of which are lifting buckets, so that the material is delivered out through the central casting. The machine has sixteen bearings, thus distributing the load and eliminating danger of heated bearings. The furnace is independent of the machine and located in a convenient place, although generally placed close to the head of the dryer.

The heated air passes through the inner cylinder and returns between the outer and inner cylinders to the fan, passing on the way the material to be dried. By reason of the inclination and revolution of the dryer the material is advanced to the discharge end. This dryer is especially suitable for drying cement rock, clay, coal, ores, sand, gypsum, fullers earth, peat, sewage sludge, tankage, etc., etc.

**Class "B" Dryer.**—For such materials as oil, kaolin, and ochre, which cannot be dried by direct heat on account of the danger from ignition or injury of the materials by furnace gases, we build a dryer similar in all respects to the Class "A" machine except the gases are taken from the inner flue and returned through a number of tubes.

**Class "E" Dryer.**—For drying nitrate of soda and other fusible salts which are not injured by direct heat but which cannot be dried in a rotary dryer, on account of the material adhering to the shell, we build a special dryer which has the advantage of direct heat with positive feed and delivery.

**Class "F" Dryer.**—When the quantity of material to be dried is small or the amount of moisture to be evaporated is light, we build a dryer of single shell construction, and while not as economical in fuel cost as our Class "A" dryer is much lower in first cost.

# THE CARBORUNDUM COMPANY

NIAGARA FALLS, N. Y.

New York, Chicago, Boston, Pittsburg, Philadelphia, Cleveland, Cincinnati, Milwaukee,  
London, Eng.

**MANUFACTURERS OF ABRASIVE MATERIALS, CARBORUNDUM AND  
ALOXITE GRINDING WHEELS, CARBORUNDUM PAPER AND CLOTH,  
ALOXITE CLOTH, CARBORUNDUM BRAND GARNET PAPER, CAR-  
BORUNDUM SHARPENING STONES**

---

## CARBORUNDUM GRINDING WHEELS

FOR cast iron, brass, bronze, aluminum, general machine shop work, for cylindrical, internal or surface grinding of metals of low tensile strength, for grinding pearl, marble, granite and porcelain.

## ALOXITE GRINDING WHEELS

FOR steel grinding, malleable iron, reamers, cutters, drills, planer tools, knife grinding, cylindrical, internal or surface grinding where the material is steel.

*Made in any standard shapes or sizes, or in any special shapes or sizes, subject to blue prints.*

## THE RIGHT WHEEL IN THE RIGHT PLACE

This is the secret of efficient and economical grinding. Our service department is at your command to give you the benefit of years of experience in all classes of grinding—to give you proper wheel-right grit, right grade. Let us know about your grinding conditions—there is a Carborundum or Aloxite wheel to meet every grinding condition.

Performances—things actually done by Carborundum and Aloxite wheels—are the most convincing arguments in favor of their merits. Send for these illustrated records—they are shown in our "efficiency booklet." Let us arrange to send you a trial wheel. We can better your grinding conditions.

# ALLITH-PROUTY COMPANY

GENERAL OFFICES AND FACTORY

DANVILLE, ILLINOIS

BRANCH OFFICES AND WAREHOUSES

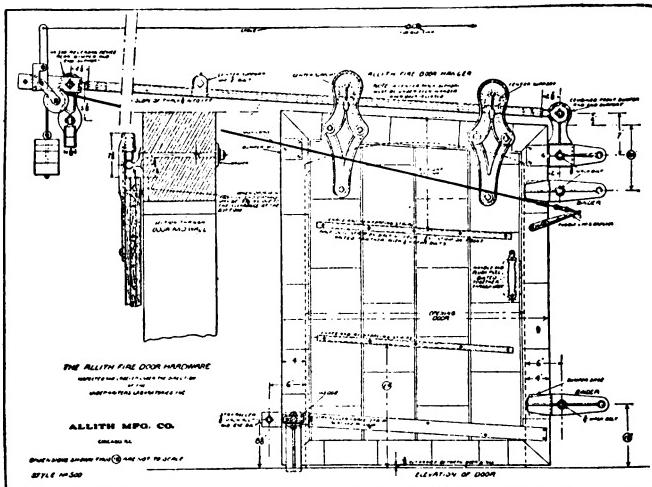
Chicago  
Boston

New York  
San Francisco

Philadelphia  
Los Angeles

Manufacturers of

DOOR HANGERS FIRE DOOR HARDWARE BUILDERS' HARDWARE  
STORE LADDERS MERCHANTS CARRIERS FLOOR HINGES



Allith hardware is inspected by the Underwriters' Laboratories Incorporated, under direction of the National Board of Fire Underwriters.

We manufacture the largest and most complete line of Sliding Door Hardware suitable for carrying sliding doors of all kinds, and call special attention to our round track hangers for warehouse and factory doors of different styles, weights and thicknesses.

Allith Fire Door Hardware is the easiest and simplest to install, strongest and most efficient, durable and satisfactory hardware made. Automatic closing devices are supplied in various styles to meet any requirements, none of them interfering with the free and easy operation of doors.

Our Parallel Door Equipment insures perfect movement of continuous parallel doors, permitting an opening at any place desired, and is the only absolutely storm-proof arrangement.

Our Merchandise Carriers for factories and warehouses are the simplest, strongest and easiest-running. Made from the highest grade malleable iron and guaranteed in their various sizes to carry safely any loads from 250 pounds to 4000 pounds.

Catalogues, detail drawings, specific information and estimates gladly furnished on request.

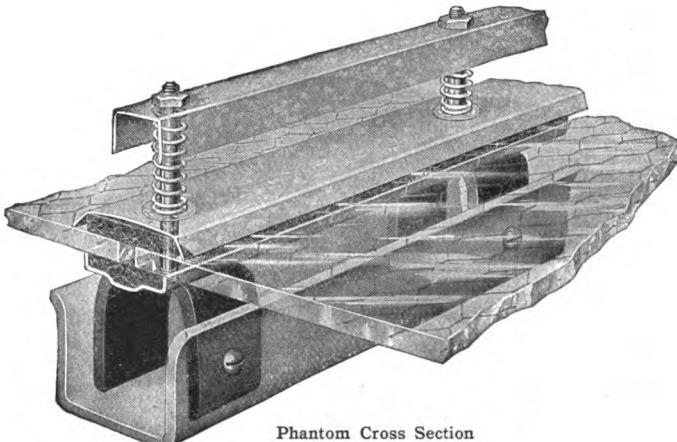
# THE G. DROUVÉ COMPANY

BRIDGEPORT, CONN.

Telephone Connections  
Western Union Code

Branch Offices  
180 N. Dearborn St., Chicago, Ill.

## **"ANTI-PLUVIUS" PUTTYLESS SKYLIGHT AND SASH OPERATING DEVICES**



Phantom Cross Section

### **"ANTI-PLUVIUS" PUTTYLESS SKYLIGHT**

The "Anti-Pluvius" Skylight is weather-proof. It can be furnished in any type and will be found to be a permanent construction. The glass is bedded on cow-hair felt which provides a cushion resting surface to take up shock, vibration or expansion and contraction. The weight of a man on the bridge is carried through to the supporting channels below without contact with or pressure on the glass. Each light is independent of every other and does not come in contact with metal, thus doing away with condensation from sweating. Manufacturers in general are gradually replacing old and worn out skylights with the "Anti-Pluvius," thereby establishing a standard and doing away with much crackage and breakage of glass. Other information furnished on request, together with estimates.

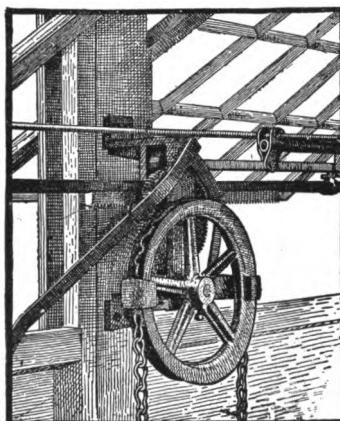
### **"STRAIGHT-PUSH" SASH OPERATOR**

The "Straight-Push" Sash Operator operates any number of sash positively, quickly, and with individual power applied to each sash. A rack and pinion moving a line of  $\frac{3}{4}$ " pipe, supported by brackets, backwards and forwards, is the guiding principle, and a push or pull is secured instead of torsion.

The main guide lever-arms are of  $\frac{1}{2}$ " steel. The supporting brackets are formed of  $\frac{1}{4}$ " steel with cast-iron spools on bearing shafts of phosphor bronze. The operating wheel has cut-steel gears with steel shaft controlling a cut-steel rack and pinion. The few connections are made with phosphor bronze washers between to prevent these parts rusting together.

A one-man control gives sufficient power to operate lines of sash 100, 200 or more lineal feet.

Full information on request.



Straight-Push Sash Operator

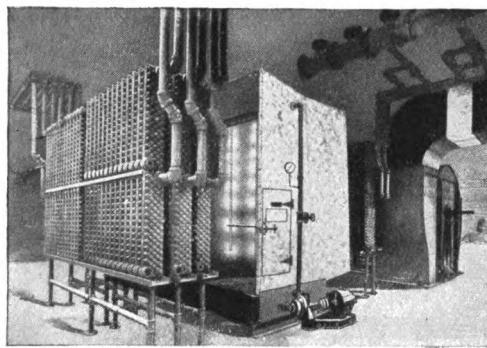
## Air Purifying and Cooling Systems

### THOMAS & SMITH, INC.

116 CARPENTER ST.  
CHICAGO

416 BROADWAY  
NEW YORK

**THOMAS' ACME AIR PURIFYING AND COOLING SYSTEM. MANUFACTURERS ALSO OF "STERLING" PORTABLE AIR PURIFIERS AND ECONOMY PUMPS AND WATER SYSTEMS**



Ideal Conditions of Health and Comfort are attained in rooms supplied with air Sweetened and Cooled by

#### THOMAS' ACME AIR PURIFYING AND COOLING SYSTEM

"Air Cooling by Contact" by multiple sheet sprays results in a clean, sweet and dry air. Nozzles that volatilize and vaporize the spray water, cooling by saturation, results in a muggy, heavy, humid air.

#### WASHED AIR MEANS by our iron-clad guarantee

98½% elimination of Dust, Soot, Germs and Gases.

Any desired percentage of humidity by means of our automatic control.

Temperature reduced 9° to 80° F. below outside summer air.

#### DISTINCTIVE FEATURES of Acme Air Purifying and Cooling System include

1. Patented feature of spraying in flat, solid sheets.
2. Bar and lock, swinging spoon brass spray nozzle.
3. Automatic Cleansing and flushing control.
4. Vertical Self-cleansing, non-perforated baffle plates.
5. Removable spray shields protecting casing.

#### AUTOMATIC FLUSHING CONTROL is an added Cleansing Feature—Piping and Nozzles Blown Out Periodically Two to Ten Times an Hour.

CONDITIONED AIR for Textile Mills and Manufacturing Processes, Banks, Hotels, Theatres and Public Buildings means added efficiency and profits.

THOMAS' "ACME" Air Purifying, Cooling and Humidifying "Washed Air" SYSTEM as shown is installed in the Vanderbilt Hotel, New York, and New Congress Hotel, Chicago, Blackstone, Congress, La Salle and Planters' Hotels, Chicago; Seelback Hotel, Louisville; Claypool Hotel, Indianapolis; New Ritz-Carlton Hotel, New York, two units, 57,500 C.F.M. being installed.

The system of washing and refrigeration by spraying water over direct expansion C O2 coils in multiple air chambers was originated by T. & S. engineers years ago, and first demonstrated in Old Auditorium Hotel, 1904.

Write for new beautifully illustrated "ACME" 80-page booklet.

#### CAPACITY, HORSEPOWER, WATER CONSUMPTION AND WEIGHTS OF THOMAS' "ACME" AIR WASHERS

Air Capacity, C.F.M.	Area Sq. Ft. Cross Section	Size Pump	H.P. Motor	R.P.M. of Pump	G.P.M. Pump Capacity	Shipping Weight	
						18 Lb. G. I.	18 Oz. Cop.
2,000	4	1½"	¾	1800	16	375 lb.	275 lb.
3,500	7	1½"	1	1800	19	470 "	350 "
5,000	10	1½"	1	1600	30	650 "	490 "
7,500	15	1½"	1½	1600	38	1000 "	700 "
10,000	20	1½"	1½	1200	44	1200 "	850 "
12,500	25	1½"	2	1200	55	1400 "	1000 "
15,000	30	2"	2	1200	72	1600 "	1150 "
18,000	36	2"	2	1200	90	1850 "	1330 "
20,000	40	2"	2	1200	100	2000 "	1500 "
25,000	50	2½"	3	1100	120	2350 "	1760 "
30,000	60	2½"	3	1100	145	2500 "	1930 "
35,000	70	2½"	3	1100	165	2650 "	2050 "
40,000	80	2½"	3	1100	185	2800 "	2180 "
50,000	100	3"	5	1000	240	3300 "	2425 "
60,000	120	3"	6	1000	280	3900 "	2680 "
70,000	140	3½"	7½	1000	320	4400 "	2900 "
80,000	160	3½"	7½	1000	370	4900 "	3150 "
100,000	200	4"	10	1000	475	6000 "	3700 "
125,000	250	5"	12½	900	600	7300 "	4600 "
150,000	300	6"	15	900	700	8400 "	5500 "
175,000	350	6"	18	900	830	9500 "	6300 "
200,000	400	6"	22	1000	1000	11500 "	7300 "

## TINIUS OLSEN AND COMPANY

500 NORTH 12TH STREET, PHILADELPHIA, PA.

### TESTING MACHINERY AND INSTRUMENTS

We manufacture a complete line of Olsen testing machines for the Physical testing of any material under any condition. These machines are designed for accuracy, sensitiveness, rigidity, strength and endurance, and they are today the recognized Standard of high grade testing the world over.

We also are the exclusive manufacturers for the "Turner" impact testing machine, "Fremont" impact testing machine and "White-Souther" endurance testing machine and exclusive American Agents for the "Herbert & Fletcher" file tester and tool steel testing machine.

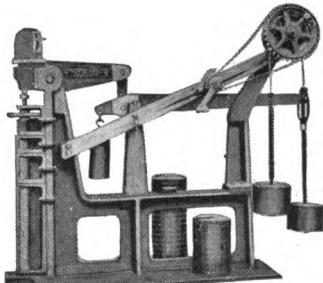
We build machines for applying all tests as enumerated below and are prepared to design and build special machines for determining any physical property.

Our Catalogue is divided into eight parts as follows:

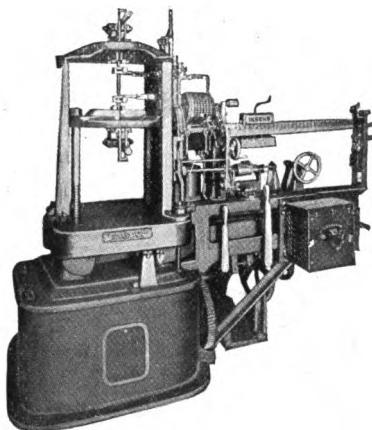
- Part A Universal Testing Machines and Instruments.
- Part B Spring Testing Apparatus and Spring Machinery.
- Part C Cement and Concrete Testing Machinery.
- Part D Cloth, Yarn, Paper, Rubber and Leather Testing Machinery.
- Part E Wire, Chain and Anchor Testing Machinery.
- Part F Oil, Grease, Bearing Metal Testing Machines, Viscometers, Dynamometers, etc.
- Part G Transverse Testing Machinery.
- Part H Special Testing Machinery. (Impact, Indentation, Vibratory, Hardness, Endurance, Bending and Torsion Testing Machinery.)

Any of the above parts mailed upon request.

Our Olsen Testing Machines have received the highest awards at the following Expositions:—



Olsen's New Hardness Testing Machine  
Patent Applied For.



Olsen's Universal Autographic Testing Machine  
Three Screw Type with Direct Motor Drive.  
Patented January 7, 1908.

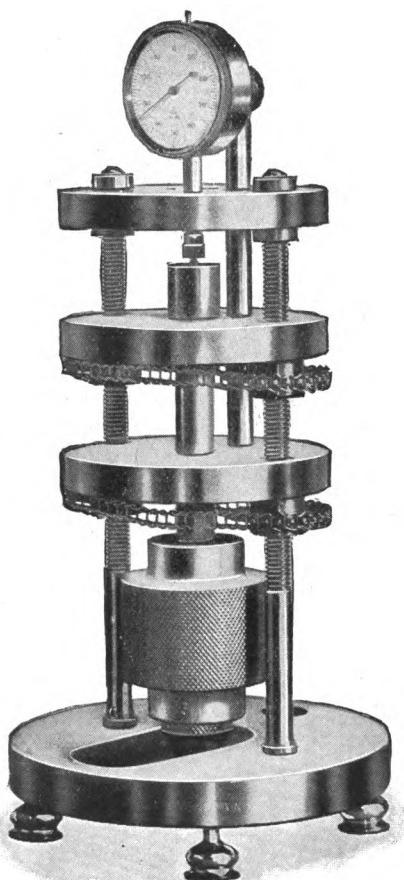
Cincinnati Industrial Exposition, 1881.  
International Cotton Exposition, Atlanta, 1881.  
World's Industrial & Cotton Centennial Exposition, New Orleans, 1885.  
World's Columbian Exposition, 1893.  
Export Exposition, Philadelphia, 1899.  
Paris Exposition, 1900.  
Louisiana Purchase Exposition, 1904.  
Jamestown Tercentennial Exposition, 1907.  
Alaska-Yukon-Pacific Exposition, 1909.  
Also  
Elliott-Cresson Gold Medal, Franklin Institute of Philadelphia, Pa.

## THE PUSEY & JONES COMPANY

WILMINGTON, DELAWARE, U. S. A.

ENGINEERS AND MANUFACTURERS OF PULP AND PAPER MAKING  
MACHINERY. MARINE EQUIPMENT. CHEMICAL APPARATUS

### THE PLASTOMETER



The Plastometer

The Plastometer measures and indicates the degree of plasticity of rubber, leather, fibre or any other resilient material.

The degree of plasticity is found by measuring the resistance offered by the material to be tested to the penetration of a needle.

Any material may therefore be standardized as to its plasticity.

For example: most of the larger rubber manufacturers have installed Plastometers. In ordering new rubber, or in re-ordering for duplication, the degree of plasticity may be specified by including in the order the words "Plastometer density of \_\_\_\_." Thus may be insured the duplication of any particular material, while the Plastometer also enables the buyer to check up the plasticity on receipt of the goods.

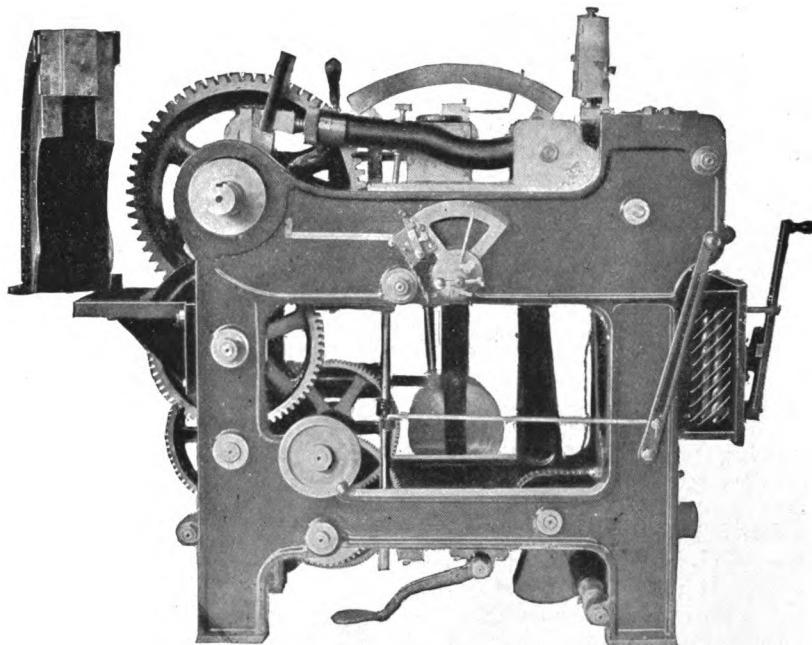
The Plastometer is furnished in a portable mahogany case, and may be easily operated and understood with a few moments' instruction.

The price is \$100.00.

**SHORE INSTRUMENT & MFG. CO.**

555-557 W. 22 ST., NEW YORK, N. Y.

**SCIENTIFIC TESTING APPARATUS**



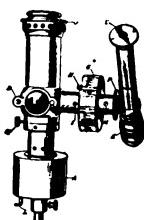
THE SHORE UNIVERSAL COMPENSATING STRENGTH TESTING MACHINE, SET UP FOR CANTILEVER BEND TESTS. (Guard thrown back to show Gear wheel.)

**THE SHORE COMPENSATOR (Autographic)**

Functions of the Shore Compensator: Takes any size test piece and gives square inch readings on chart. Automatic weighing (therefore fool proof), quick acting and making the following tests:—Cantilever bend test (principal feature), Tension, Gear teeth, Torsion, Compression and shear.

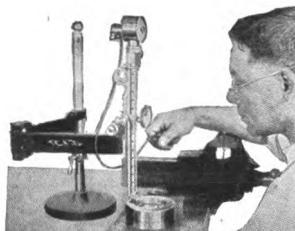
The only machine suitable also for commercial inspection room work. Catalog free.

We make also the *Scleroscope*. The *Pyroscope* and *Enamelite* (for selective carbonizing).



**Pyroscope  
Optical Temperature Gauge**

Send for Catalogs.



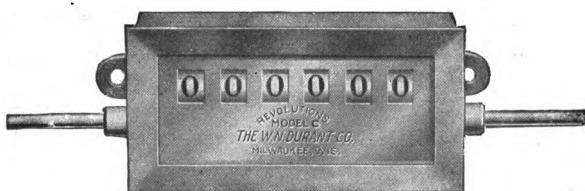
**Scleroscope  
World Standard Hardness Tester**

## *Counting Machines*

# THE W. N. DURANT CO.

MILWAUKEE, WIS.

MANUFACTURERS OF COUNTERS



### DURANT COUNTING MACHINES

A large proportion of the time and labor saving devices now in general use require a counter of some form as an essential part of their mechanism. These instruments differ so widely in application that their manufacture has become a distinct industry. Our long experience in this single line of business not only gives us prestige as pioneers, but enables us to offer counters, the superior qualities of which have been proved by the test of time and in thousands of uses.

The machines illustrated here show three of our five distinct models, while each is made with various numbers of digit wheels and in several styles, such as reciprocating, rotary, star wheel, lineal measure, etc. Furthermore several forms of resetting devices can be supplied, including a new instantaneous mechanism.



Durant Counters are particularly well adapted to use on Punch Presses, Pumping Engines, Textile and Wood-Working Machinery, Automatic Scales, Water Weighers, Conveyors, Coal and Ore Handling Machinery, Voting Machines, Office Appliances, and other Automatic Machinery.

They are constructed so as to be available for the greatest possible variety of uses, and with trifling modifications can be made to cover the difficulties of almost any situation. If a counter of ordinary form should not meet your requirements, your problem may be submitted to us for speedy solution.



1913 Catalog sent on request.

# THE VEEDER MANUFACTURING CO.

HARTFORD, CONN.

**MAKERS OF CYCLOMETERS, ODOMETERS, TACHOMETERS, TACHODIMETERS, COUNTERS AND FINE DIE CASTINGS.**

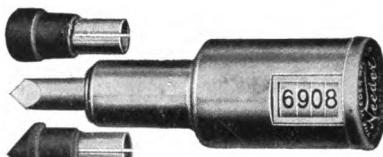
## COUNTERS AND TACHOMETERS

Absolutely reliable instruments for the indication of speed or the recording of output from machines.

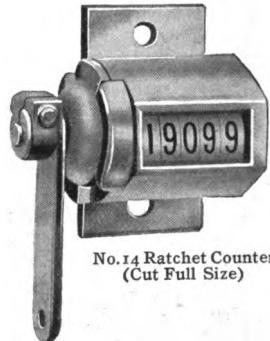
Essential in Scientific Management for the Piece Work Records.

### ELEVATOR MILEAGE

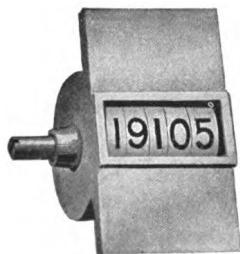
Recorders which we furnish make it possible to keep satisfactory records of service and upkeep.



Veeder Clutch Speed Counter



No. 14 Ratchet Counter  
(Cut Full Size)



No. 4 Revolution Counter  
(Cut Full Size)

Counters, both ratchet and revolution, for practically every purpose. Especially suitable for use on Punch Presses, Voting Machines, Cash Registers, Slot Machines, Railway Semaphores, Neo-styles, Telephone Pay Stations and Automatic Machinery. We illustrate only two of our many styles.

### VEEDER FORM C TACHOMETERS

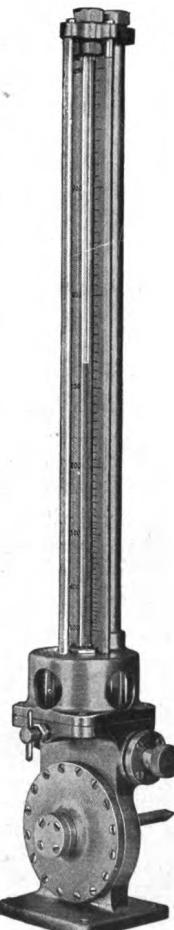
The Form C Tachometer is a portable instrument for indicating revolutions per minute of dynamos, motors, shafting, etc. The only moving part is the paddle wheel in the centrifugal pump. This has radial blades and hence indicates when run in either direction. When paddle is revolved, the liquid is forced out of pump and up the indicating tube by centrifugal force.

### FINE DIE CASTINGS

When accurately made parts are wanted in large quantities, they may be manufactured most economically by casting to their finished size and shape. Our

alloy has a tensile strength of about 15,000 lbs. and compressive strength of 20,000 lbs. It is about equal in strength to aluminum or cast iron.

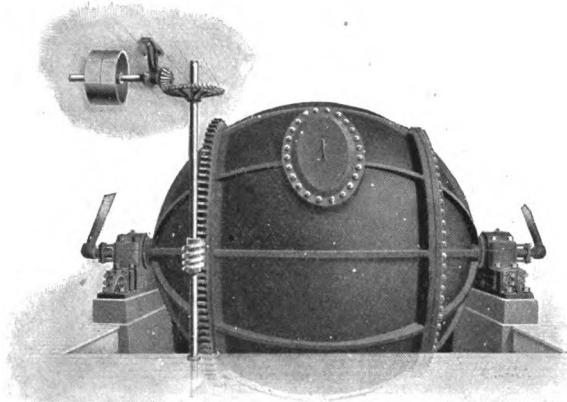
Complete Catalogue on request.



Form C Tachometer

THE  
HOOVEN, OWENS, RENTSCHLER  
COMPANY  
HAMILTON, OHIO

SUGAR MACHINERY, CAST IRON GLOBE DIGESTERS AND COOKERS FOR PAPER MILLS AND BLEACHERIES, PLATE GLASS FINISHING MACHINERY, SEMI-STEEL, STEEL RE-INFORCED ANVIL BLOCKS, FLEXIBLE COUPLINGS, AND SPECIAL HEAVY CAST IRON CASTINGS.



Globe Digester and Cooker

The cast iron Globe Digester and Cooker is made in sizes up to and including 12 feet in diameter and is equipped with adjustable babbittted trunnion bearings. The drive may be from the ceiling hangers, as shown in illustration, or from beneath the floor—at the option of purchaser.

The Anvil Blocks are made in any size and arranged to accommodate any make of hammer. They are composed of a special mixture of semi-steel and thoroughly steel-re-inforced by the HAMILTON process.

The Sugar Mill Housing shown is thoroughly triangular bolt bound, and of such design that the completed housing is of maximum possible strength in every direction. This illustration shows more plainly than any description its excellent design for resisting the enormous pressures to which it is subject.



86" Semi-Steel Low Pressure Cylinder

The 86" Cylinder illustrated is a good example of our large semi-steel castings and proves that we have excellent facilities for making cast iron or semi-steel castings of any size and weight consistent with modern foundry practice.



Re-Inforced Anvil Block



Sugar Mill Housing

## M. D. KNOWLTON CO.

Main Office and Works

24 ELIZABETH ST., ROCHESTER, N. Y., U.S.A.

NEW YORK

LONDON

CHICAGO

PAPER BOX AND SHIPPING CASE MACHINERY

MACHINES FOR CUTTING, TREATING AND FORMING, PAPER, BOARD AND SHEET FABRICS.

Our experience in designing and making machines for this class of work extends over a period of thirty years. Our shop facilities are excellent. Many of the machines we manufacture are necessary to other industries as well as to that of the paper box. Below is only a partial list of the standard and automatic machines we manufacture and carry in stock. We solicit inquiries for standard and special machinery of this class.

### CUTTING MACHINES

for Slitting, Sheeting or Shape Cutting, Paper, Pulp, Fibre or Corrugated Board and Sheet Fabrics.

Scorers

Rotary Paper Slitters and Rewinders

Rotary Cardboard Slitters

Corner Cutters

Slotters and Flap Cutters

Folding Box Slotters

Roll Sheet Cutters

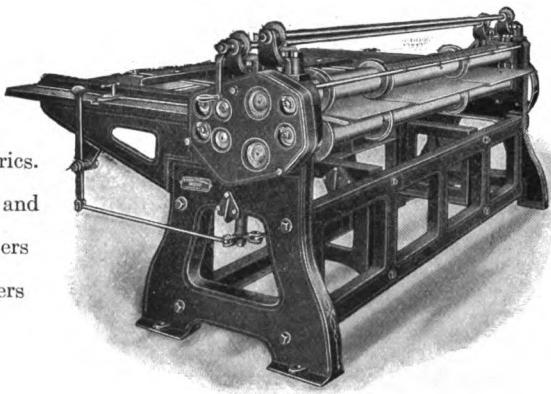
Neck Choppers

Thumbhole Machines

Skiving Machines

Round and Oval Cutters

Rotary Cutting Knives



Heavy Rotary Slitter for Fibre and Corrugated Board

### TREATING MACHINES

for Coating Paper and Cardboard with Glue, Silicate of Soda, Paste and other Liquid Solutions.

Automatic Gumming Machines

Plain Gumming Machines

Sheet Gluers

Sheet Pasters

Flange Gluers

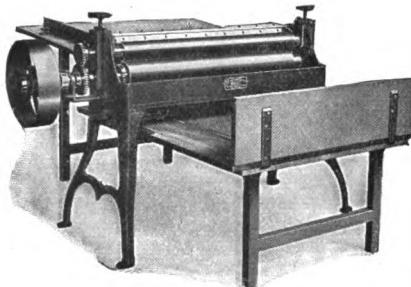
Folding Box Gluers

Paraffine Coaters

Silicate of Soda Coaters

Glue Cookers and Mixers

Glue Pots



Paraffine Coating Machine

### FORMING MACHINES

for Creasing, Bending and Shaping Paper and Cardboard.

Automatic Creasers and Slotters

Folding Box Creasers

Flange Benders

Plain Corner Stayers

Turn-in Corner Stayers

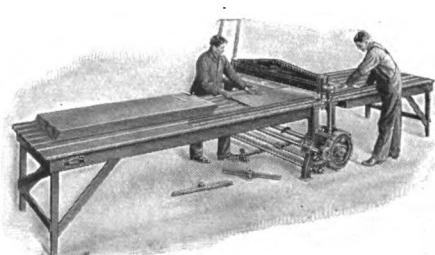
Ender and Corner Stayers

Tape Stayers

Covering Machines

Topping Machines

Trimming Machines

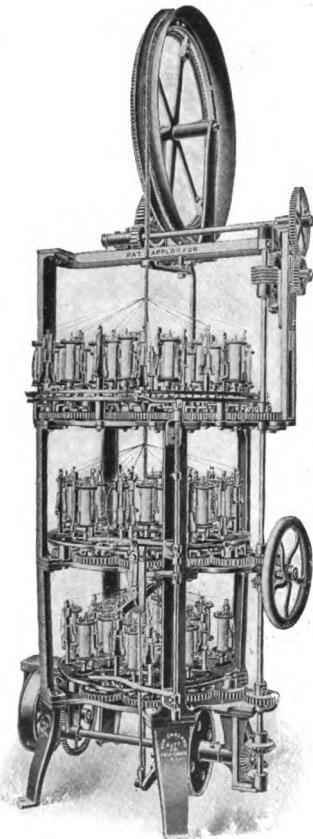


Straight Bar Creaser for Fibre and Corrugated Board

**NEW ENGLAND BUTT COMPANY**  
PROVIDENCE, R. I.

European Agents: Selson Engineering Company, Ltd., London, England

MANUFACTURERS OF BRAIDING MACHINERY, MACHINERY FOR INSULATING WIRES AND CABLES.



Double Deck 16x20x24.  
No. 1 Cable Braider.

Taping Machinery for taping wires or cables with paper or other materials.

Polishing Machines, for insulated wires and cables from the small sizes up to 3" cables.

Wire Measuring Machines.

Twining Machines.

Rubber Strip Covering Machines, for applying rubber insulation to wires and cables with either single or double seam. These machines are built in several sizes and handle from one up to twenty wires at a time.

**BRAIDING MACHINERY**

**American and German Type**

Used for making plain and fancy braids for dress trimmings and millinery, round and flat shoe laces, soutache braids, candle wicking, tapes, cords, banding, clothes lines, fish lines, packing, gas tubing and rubber hose, round and flat elastic.

Sash Cord Braiders for making solid sash and curtain cord of various sizes.

Sash Cord Finishers for polishing solid sash cord.

Silk Covering Machines for covering cotton with silk.

Braid Spooling and Measuring Machines.

Rubber Spreading Machines, built of any desired width for applying a thin coating of rubber to cloth.

**INSULATING MACHINERY.**

**Single, Double and Triple Deck Braiders.**

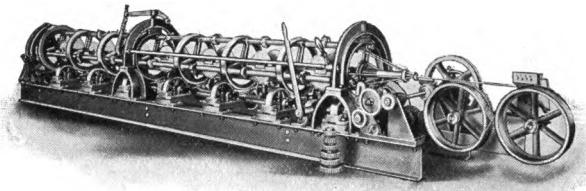
These are made in all sizes and combinations for covering wires from small sizes up to large cables.

Magnet Wire Machinery for silk and cotton covering arranged to handle round and flat wires.

Annunciator Wire Winders, Single, Double or Triple Deck.

## NEW ENGLAND BUTT COMPANY

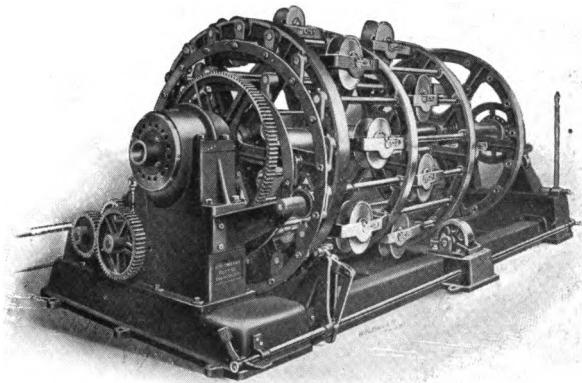
MACHINERY FOR THE MANUFACTURE OF WIRE ROPES AND CABLES



### 7 REEL HIGH SPEED STRANDING MACHINE.

In this type of machine the reels are carried in stationary cradles hanging at the center of the machine and the frame revolves about them.

By this construction, the machine being perfectly balanced, a very high speed is attainable. It is built in several sizes from small machines, for making the initial strands of small wire ropes, up to large laying machines holding 2000 lbs. to each reel. It is also built for making 19 wire strand.



### 24 REEL HORIZONTAL CABLING MACHINE.

This machine is of the planetary type in which the reels are kept in a vertical position by means of cranks and an eccentric ring at the rear of the machine.

It is built in single heads or in tandem form with any combination of heads and is used for making cables of concentric strand and also for armoring cables.

We are prepared to furnish this type of machine in a large variety of sizes.

Take up Fixtures for the above machines are built in either the single drum or the double grooved drum types.

Wind up Reel Fixtures with automatic and adjustable traverse motions can be furnished suitable to handle any size of reels.

## VULCAN ENGINEERING SALES CO.

2007 Fisher Bldg.

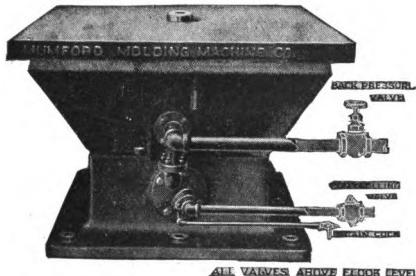
CHICAGO, ILL.

2007 No. 30 Church St.

NEW YORK, N. Y.

CONTROL ENTIRE SALES AND PRODUCT

### MUMFORD MOLDING MACHINE CO.



#### JOLT RAMMING MACHINES

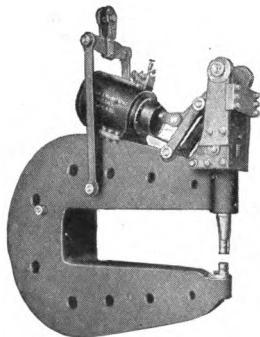
Pneumatic and Electric

#### SPLIT PATTERN MACHINES

POWER AND HAND SQUEEZERS

VIBRATORS AND RAPPERS

FOUNDRY EQUIPMENT



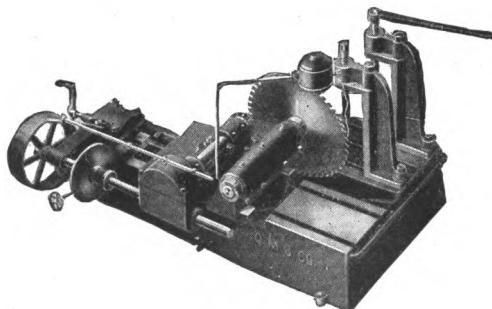
### HANNA ENGINEERING WORKS

#### PNEUMATIC RIVETERS

From 6 in. reach x 6 in. gap, 20 tons pressure, to  
126 in. reach x 24 in. gap, 150 tons pressure.

PLAIN TOGGLE (Pinch Bug) AND COMPRES-  
SION LEVER RIVETERS  
SHAKERS AND RIDDLES, Air or Electricity

### THE Q M S COMPANY



#### METAL SAWING MACHINERY

Saws for Cold Cutting Off.  
For Foundry and Struc-  
tural Shop.  
Power Hack Saws.  
All Styles  
CRANES, HOISTS  
GENERAL SHOP EQUIP-  
MENT

Complete Catalog of All Goods on Request





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